



Final 5-Year Review

Record of Decisions for:

21 No Action Sites

41 No Action Sites

Source Control Operable Unit, Landfills 8 & 10

Off-Source Operable Unit

Spill Sites 2, 3, and 10 (OU2)

Wright-Patterson Air Force Base

IT Project No. 777097

Submitted to:

**Wright-Patterson Air Force Base
Office of Environmental Management
Wright-Patterson Air Force Base, Ohio**



**Environmental Management
Wright-Patterson AFB**

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Acronyms

ARAR	Applicable or Relevant and Appropriate Requirements
B89CSP	Building 89 Coal Storage Pile
BMP	Basewide Monitoring Program
BS	Burial Site
BTEX	benzene, toluene, ethylbenzene, xylene
BUSTR	Bureau of Underground Storage Tank Regulations
CCSA	Coal and Chemical Storage Area
CDA	Chemical Disposal Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Chemical of Concern
DoD	U.S. Department of Defense
EA	Environmental Assessment
EE/CA	Engineering Evaluation/Cost Analysis
EFDZ	Earthfill Disposal Zone
EOD	Explosive Ordinance Disposal
ESD	Explanation of Significant Differences
EW	Extraction Well
FS	Feasibility Study
ft	feet
FTA	Fire Training Area
GLTS	Gravel Lakes Tank Site
GPR	Ground Penetrating Radar
GWOU	Groundwater Operable Unit
HDPE	high-density polyethylene
HP	Central Heating Plant
HpCDD	1, 2, 3, 4, 6, 7, 8-heptachlorinated dibenzo-p-dioxin
HpCDF	1, 2, 3, 4, 6, 7, 8-heptachlorinated dibenzofuran
HxCDD	1,2,3,4,6,7,8-hexachlorinated dibenzo-p-dioxin
HVL	horizontal gas vent layer
IRP	Installation Restoration Program
LEL	lower explosive limit
LF	Landfill
LFG	Landfill gas
LTCSA	Long-Term Coal Storage Area
LTM	Long-term Monitoring
MCD	Miami Conservancy District
MCL	Maximum Contaminant Level
mg/L	Milligrams per liter
µg/L	Micrograms per liter

NA	No Action
NCP	National Contingency Plan
NPDES	National Pollution Discharge Elimination System
NUC	Deactivated Nuclear Reactor
OAC	Ohio Administrative Code
OCDD	1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin
OEPA	Ohio Environmental Protection Agency
O&M	Operation and maintenance
OSOU	Off-Source Operable Unit
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
POL	Petroleum, Oils and Lubricants
POTW	Publicly Owned Treatment Works
PRG	Preliminary Remediation Goal
RADB	Radioactive Waste Burial Site
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SCOU	Source Control Operable Unit
SI	Site Investigation
SP	Spill Site
SSRAP	Site-Specific Removal Action Plan
SVOC	semivolatile organic chemical
TCDD	2, 3, 7, 8,-tetrachlorodibenzo-p-dioxin
TCDF	2, 3, 7, 8-tetrachlorodibenzofuran
TCSP	Temporary Coal Storage Pile
TF49	Tank Farm 49A
TIC	Tentatively Identified Compound
TPH	Total Petroleum Hydrocarbon
UEL	upper explosive limit
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WPAFB	Wright-Patterson Air Force Base

1.0 Introduction

In accordance with Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and Section 300.430(f)(4)(ii) of the National Contingency Plan, this document presents the five-year review of five Records of Decisions (RODs) for Wright-Patterson Air Force Base (WPAFB). Five-year reviews are intended to evaluate whether (1) the response action presented in the ROD remains effective at protecting public health and the environment and (2) the original cleanup levels remain protective of human health and the environment (USEPA, 1991; USEPA 1995).

Five-year reviews consist of two types: (1) Statutory Reviews, reviews consistent with CERCLA Section 121(c) and the National Contingency Plan (NCP), are conducted at sites where hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure following completion of the remedial action; and (2) Policy Reviews, reviews not required by CERCLA Section 121(c), are reviews that the United States Environmental Protection Agency (USEPA) believes should be conducted, as a matter of policy. The review presented herein is a Level I Statutory Review (USEPA, 1991; USEPA, 1995). Level I is the lowest level of evaluation of protectiveness. Remedial action started at WPAFB on September 3, 1994 when work began on the Source Control Operable Unit. Thus, this date is the trigger date for the start of the five-year review period.

1.1 Purpose of Review

The purpose of this document is to review the remedy for five RODs issued at WPAFB to determine if the remedies presented in the decision documents remain protective of human health and the environment. Although less than five years has passed since the remedy for three of the RODs was implemented, a review is being conducted at this time to enable all sites under the Installation Restoration Program (IRP) at WPAFB to be reviewed in a similar time frame.

1.2 Scope

The scope of the review contained in this document is five RODs issued for WPAFB. These RODs include:

- Record of Decision for 21 No Action Sites, 26 August 1996

- Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, 20 August 1998
- Record of Decision, Source Control Operable Unit, Landfills 8 and 10, 24 May 1993; and subsequent Explanation of Significant Differences, 26 March 1997
- Record of Decision Off-Source Operable Unit and Final Remedial Action, Landfills 8 and 10, June 1994
- Record of Decision for Spill Sites 2, 3, and 10 (Operable Unit 2), 1997.

1.3 Report Organization

This report is organized in accordance with the following guidance from USEPA on conducting five-year reviews:

- Structure and Components of Five-Year Reviews, OSWER Directive 9355.7-02, May 23, 1991
- Supplemental Five-Year Review Guidance, OSWER Directive 9355.7-02A, July 26, 1994
- Second Supplemental Five-Year Review Guidance, OSWER Directive 9355.7-03A, December 21, 1995.

The remainder of this document is divided as follows: WPAFB background is presented in Chapter 2.0. Site characteristics, remedial objectives, current site conditions, and recommendations for each ROD are presented in Chapters 3.0 through 7.0. Each of these chapters has been prepared in a stand-alone format so that it can be extracted from the compendium. A summary of recommendations for each ROD is presented in Chapter 8.0, and the statement of protectiveness is provided in Chapter 9. Chapters 10 and 11 provide information on when the next review will be conducted and outlines a proposed implementation plan for changes to the current remedy, if necessary.

2.0 Background

WPAFB is located in southwestern Ohio, east of the city of Dayton and adjacent to the city of Fairborn (Figure 2-1). The base is approximately 60 miles north of Cincinnati and 50 miles west of Columbus and occupies approximately 8,500 acres of Greene and Montgomery Counties, immediately adjacent to Clark County.

The base is divided into three administrative areas: A, B, and C (Figure 2-2). Areas A and C surround Patterson Field, an active U.S. Air Force (USAF) airfield. Area B is located southwest of Areas A and C and contains Wright Field, an inactive airfield. Areas A and C, and Area B are separated by State Route 444 and ConRail Corporation railroad tracks. Areas A and C encompass 5,711 acres. Area A is primarily comprised of building complexes and Area C is primarily comprised of active runways and flight facilities. Area B encompasses approximately 2,800 acres and contains a complex of buildings and three runways that are no longer utilized for flying except occasionally when aircraft are flown in for exhibition at the Air Force Museum. Current and historical operations are oriented more toward industrial usage in general and research and development in particular.

Environmental investigations at WPAFB are conducted under the IRP. The U.S. Department of Defense (DoD) developed the IRP to identify, assess, and control potential environmental contamination that may have resulted from past operations and waste disposal practices. The IRP, an element of the Defense Environmental Restoration Program, is a part of the environmental program at each DoD installation. At WPAFB, the IRP is administered by the 88th Air Base Wing, Air Force Materiel Command, through the Office of Environmental Management, Restoration Office. The base IRP is regulated under CERCLA and by the Federal Facility Agreement with USEPA Region V and the Orders on Consent with the Ohio Environmental Protection Agency (OEPA). WPAFB currently has identified 65 IRP sites (IT, 1999a). WPAFB has grouped all confirmed or suspected sites requiring investigation and characterization into 11 geographically-based source operable units (designated OUs 1 through 11) and one groundwater operable unit. Groundwater, surface water, and sediment contaminants from each of the 11 OUs and groundwater contaminants that are not attributable to a known source on WPAFB are combined to form the Groundwater Operable Unit (GWOU) for removal

activities under the Basewide Monitoring Program (BMP). The RODs reviewed in this document include a number of IRP sites from each of the 11 OUs (Table 2-1).

3.0 21 No Action Sites ROD

3.1 Introduction

The 21 No Action Sites ROD (WPAFB, 1996) addresses remedial actions for 21 IRP sites at the base (Table 3-1). The ROD only addresses soils at these sites. The remedy selected in the ROD for each of these 21 sites was the No Action (NA) alternative; the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites. This decision was based on analytical data, restricted land uses at each of the 21 sites and the assumption that these restrictions would remain in place. A five-year review of the selected remedial alternative of NA is necessary to determine whether land use restrictions, as presented in the ROD, remain at each of the 21 sites. If, in the future, portions of WPAFB are sold for residential development, for example, the appropriate land use would need to be evaluated for those specific applications.

3.2 Site Characteristics

A site by site description of the 21 No Action Sites, by operable unit (OU), is presented in the ROD for the 21 No Action sites (WPAFB, 1996). Figures 3-1 and 3-2 show the location of the sites addressed in the 21 No Action Sites ROD.

3.3 Remedial Objectives

There were no remedial objectives selected for any of the 21 No Action sites. The No Action alternative was selected as remedy for all 21 sites (i.e., the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites). As discussed in Section 3.1, this decision was based on the evaluation of analytical data and current site conditions. Institutional controls and access/land use restrictions are in place at all of the sites (e.g., most are located within an active military installation with limited access). Additionally, some sites have fencing around them, further limiting access. Digging or excavation at any of the 21 sites, especially those with waste/contamination left in place [(e.g., LF13, Heating Plant 3 (HP3), Fire Training Area (FTA5)], is currently restricted by the nature of the installation and is expected to remain restricted.

The following section briefly describes the results of previous investigations and the rationale for the no action remedy proposed for each site, by operable unit.

3.3.1 OU2

The remedial investigation (RI) performed at OU2 concluded that no remedial action was needed at the five sites because soil contamination was found below action levels. Recreational and industrial use of the land at these sites reduces the risk to people, plants and animals by limiting exposure to these areas. Contamination in the soils at these sites and the risk it causes does not create any danger. These sites are also located within the boundaries of WPAFB, which is a restricted military installation with institutional controls in place to prevent uncontrolled access to these sites.

3.3.2 OU3

The RI performed at OU3 concluded that no remedial action was needed at the eight sites to protect human health and the environment. Contamination in the soils at these sites and the risk it causes does not create any danger. The land use at OU3 is restricted to recreational (hunting and camping) and light industrial (fire training) activities which reduces the risk to people, plants and animals by limiting exposure to these areas. These sites are also located within the boundaries of WPAFB, which is a restricted military installation with institutional controls in place to prevent uncontrolled access to these sites.

3.3.3 OU5

The site investigation (SI) and RI performed at OU5 concluded that no remedial action was needed at the three sites because contaminants detected were below action levels and pose minimal risk to human health.

3.3.4 OU6

The RI performed at OU6 concluded that no remedial action was needed at Earthfill Disposal Zone 1 (EFDZ1) to protect human health and the environment. The petroleum hydrocarbons detected in soil at the site is likely influenced by the asphalt walking path in the community park and automobile exhaust and road runoff from Harshman Road, a heavily traveled thoroughfare adjacent to EFDZ1. Petroleum hydrocarbons, which are the most commonly detected contaminants at these No Action sites, degrade rapidly. As such, biodegradation of the

petroleum hydrocarbon within the EFDZ1 site will continue, with or without any engineered remedy. Contamination in the soils at EFDZ1 and the risk it causes does not create any danger.

3.3.5 OU10

The RI performed at OU10 concluded that no remedial action was needed at the four sites. Contamination in the soils at these sites and the risk it causes does not create any danger. These sites are also located within the boundaries of WPAFB, which is a restricted military installation with institutional controls in place to prevent uncontrolled access to these sites.

3.4 Current Site Conditions

The No Action alternative for the sites contained in the 21 Sites ROD relied upon restricted land use and institutional controls. Therefore, if land use should change from that stated in the ROD, a review would be necessary to determine if the No Action remedy was still protective of human health and the environment.

There are currently two systems in place for alerting the Office of Environmental Management that land use could change. The first system is through the use of a permit (Form 103) that is required whenever digging will occur anywhere at WPAFB. Form 103 must be submitted to the Office of Civil Engineering prior to excavating or digging. The site is then evaluated for potential risks, including environmental exposures. The second system requires the submittal of Form 813 to the Office of Environmental Management prior to construction activities at WPAFB. The Office of Environmental Management reviews the information and determines if the proposed construction is located at or near an IRP site, or if construction activities will affect an IRP site. Based on information provided by these two systems and site visits that are conducted at the base as part of on-going environmental programs, land use is known to remain unchanged at all of the sites covered in the 21 Sites ROD. The No Action alternative remains effective as protective of public health and the environment because there is no current exposure to the subsurface contamination. In addition, the designated land use at these sites is highly likely to remain the same in the future. Current land use designations for Areas A and C and Area B are shown in Figures 3-3 and 3-4, respectively.

Operable Unit	Sites Included in ROD	Land Use
OU2	Burial Site 1; Long-Term Coal Storage Area; Temporary Coal Storage Pile; Coal and Chemical Storage Area; and Building 89 Coal Storage Pile	Commercial/ Industrial and Recreational
OU3	Landfill 14; Fire Training Areas 2, 3, 4 and 5; Spill Site 1; Earthfill Disposal Zones 11 and 12	Recreational and Light Industrial
OU5	Fire Training Area 1; Gravel Lake Tank Site; Burial Site 4	Industrial and Open/ Recreational
OU6	Earthfill Disposal Zone 1	Commercial/Industrial/ Recreational/Open
OU10	Central Heating Plant 3 and associated Battery Burial Site; Landfill 13; Tank Farm 49A; USTs at Building 30119	Light Industrial/Office

3.5 Recommendations

Based on a review of current land use restrictions at the 21 No Action sites, no changes in the selected remedy are needed. The No Action alternative remains effective as protective of public health and the environment; current land use restrictions remain in place and there is no current exposure to the subsurface contamination.

4.0 41 No Action Sites ROD

4.1 Introduction

The 41 No Action Sites ROD (WPAFB, 1998) addresses remedial actions for 41 IRP sites at the base (Table 4-1). The ROD only addresses soils at these sites. The remedy selected in the ROD for 41 No Action Sites was the No Action alternative; the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites. This decision was based on analytical data, restricted land uses at each of the 41 sites, and the assumption that these restrictions would remain in place. A five-year review of the selected remedial alternative of NA is necessary to determine whether land use restrictions, as presented in the ROD, remain at each of the 41 sites. If, in the future, portions of WPAFB are sold for residential development etc., the appropriate land use would need to be evaluated for those specific applications.

4.2 Site Characteristics

A site by site description of the 41 No Action sites is provided in the ROD for 41 No Action sites (WPAFB, 1998). Figures 4-1 and 4-2 show the location of the sites addressed in the 41 No Action Sites ROD. Although Burial Site 6 (BS6) is within the boundary drawn for OU9, this site was not included in the original 65 IRP sites (and, hence, was not included in the original listing of sites in the OUs). BS5 and BS6 were identified in 1996 as potential hazardous waste sites from aerial photographs, comments from local residents, and interviews with WPAFB personnel. A records search, conducted in September 1996 to determine the history of BS5 and 6, included an examination of aerial photographs dating from 1944. BS5 is evident on photographs from 1944 to the present, appearing as a patch of stressed vegetation approximately one acre in size. One photograph, dated 1974, indicates a road or trail leading to BS5, suggesting some activity at the site. BS6 is west and downslope of a former building structure, the foundation of which can still be seen in the field. Evidence of activities that would indicate a burial site, such as stressed vegetation or disruption of the surface, is suggested from the historical photographs, although the evidence is not conclusive.

4.3 Remedial Objectives

There were no remedial objectives selected for any of the 41 No Action sites. The No Action alternative was selected as remedy for all 41 sites because the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites. At some of these sites, namely Landfills (LFs) 1,2,3,4,5,6,7,9,11, and 12, the selected remedy was “No additional remediation action necessary” since the sites had been addressed through a non-time critical removal action. As discussed in Section 4.1, this decision was based on the evaluation of analytical data and current site conditions. Institutional controls and access/land use restrictions are in place at all of the sites. Most of the sites are located within an active military installation with limited access. Additionally, some sites have fencing around them, further limiting access. Digging or excavation at any of the 41 sites, especially those with waste/contamination left in place such as the landfills, is currently restricted by the nature of the installation and is expected to remain restricted. Maintenance of landfill caps is also an ongoing activity. If, in the future, portions of the base are sold, the appropriate land use would need to be evaluated for that specific application. For the Explosive Ordnance Disposal (EOD) Range, land use restrictions would be placed to limit land use to industrial uses.

The results of previous investigations, removal actions/presumptive remedies and the rationale for the no action remedy selected for each site, by operable unit, are discussed in the ROD for the 41 No Action sites (WPAFB, 1996). Remedial actions for several IRP sites have been addressed using a streamlined approach. Landfills with similar types of contamination (e.g. LF1 through 9, and 11) are identified in the Base-wide Removal Action Plan (BRAP) for Landfill Capping. This Base-wide program speeds up the process of cleaning up a landfill site by using remedies already approved by USEPA. USEPA refers to these actions as presumptive remedies, since they have been proven to effectively reduce risks to human health and the environment from contaminants that are commonly identified at CERCLA sites. For example, as a result of the Site-Specific Removal Action Plan (SSRAP), LF5 was designated for an early action landfill cap as a presumptive remedy. Potential exposure to soil contaminants at this site were effectively eliminated by the cap.

OEPA, USEPA, and WPAFB determined that conditions at the NA sites addressed in the 41 No Action sites ROD pose no current or potential threats to human health or the environment at levels that warrant any remedial action. Removal actions implemented at some of the 41 sites have reduced the risk to acceptable levels or have eliminated the exposure pathway. No further

action is warranted at these sites to protect human health or the environment. Thus, while some of the sites may exhibit low, acceptable levels of risk, no cleanup action is warranted because of the low frequency of human exposure and the likelihood that any attempt to further reduce risk could result in more harm than good to the environment.

4.4 Current Site Conditions

The No Action alternative for the sites contained in the 41 Sites ROD relied upon restricted land use and institutional controls to maintain protection to human health. Therefore, if land use should change from that stated in the ROD a review would be necessary to determine if the No Action remedy was still protective of human health and the environment.

At WPAFB, there are currently two systems in place for alerting the Office of Environmental Management that land use could change. The first system is through the use of a permit (Form 103) that is required whenever digging will occur anywhere at WPAFB. Form 103 must be submitted to the Office of Civil Engineering prior to excavating or digging. The site is then evaluated for potential risks, including environmental exposures. The second system requires the submittal of Form 813 to the Office of Environmental Management prior to construction activities at WPAFB. The Office of Environmental Management reviews the information and determines if the proposed construction is located at or near an IRP site, or if construction activities will affect an IRP site. Based on information provided by these two systems and site visits that are conducted at the base as part of on-going environmental programs, land use has not changed at any of the sites covered in the 41 Sites ROD. However, land use in a portion of OU9 has changed. A new Child Development Center and an addition to the Air Force Institute of Technology complex are being constructed between 12th Street and 13th Street, perpendicular to Q Street. These construction projects are located adjacent to EFDZ5. Land use at EFDZ5 will remain unaffected by these buildings.

The No Action alternative remains effective as protective of public health and the environment because there is no current exposure to the subsurface contamination. In addition, the designated land use at these sites is highly likely to remain the same in the future. Land use designation for each of the 41 sites is provided in Table 4-2. Figures 4-3 and 4-4 show current Land Use designations at the base.

In addition to restricted land use and institutional controls, the No Action alternative for LF1 through 7, 9 and 11 relied upon maintenance of the landfill caps (implemented as presumptive remedies) to maintain protection to human health and the environment. Construction at LFs 1 through 4, 6, 7, and 9 was recently completed and system performance reviews, as required in the individual operation and maintenance (O&M) plans, are scheduled to be completed later this year. The results of the most recent system performance review completed for LF5 and 11 (dated October 15, 1998) indicated only routine maintenance issues at either landfill. The primary issue noted was the presence of ground hog dens on LF5. An exploratory dig was performed to determine if the dens had damaged the cap. The dig verified that the cap had not sustained any damage due to the groundhog digging activities as the rodents' digging was confined to the vegetation layer only. To prevent potential problems from occurring, the ground hogs were exterminated. The performance review noted that the landfill side slopes at both landfills were in good conditions, and no ponding of water, cratering or erosion was observed. There were some problems noted with the drainage system at LF5, including damaged drain covers and discharge piping and some erosion in the drainage channel. These conditions were corrected. The gas vent system at LF5 was noted to be in good condition. Fences, gates, locks and signs were present, in good condition and in working order.

4.5 Recommendations

Based on a review of current land use restrictions at the 41 No Action sites, no changes in the selected remedy are necessary. The No Action alternative remains effective as protective of public health and the environment; current land use restrictions remain in place and there is no current exposure to the subsurface contamination.

5.0 Source Control Operable Unit ROD

5.1 Site Characteristics

The Source Control Operable Unit (SCOU) ROD (WPAFB, 1993) contains a portion of the overall remediation for Landfills 8 and 10 (LF8 and LF10). The ROD only addresses hazards posed by specific environmental media and is not meant to address all potential hazards posed by the site. In particular, the SCOU addresses the following environmental media and potential hazards:

- Landfill wastes and soils
- Leachate
- Landfill gases
- Ambient (breathing) air
- Private water sources.

The SCOU does not address groundwater already affected by LF8 and LF10 (i.e., down gradient). This potential hazard was addressed in the Off-Source Operable Unit (OSOU) ROD (WPAFB, 1994).

LF8 and LF10 are located in the northeast corner of Area B at WPAFB, in the area bounded by National, Kaufman, and Zink Roads (Figure 5-1). Currently, the entire area encompassing the landfills is fenced and posted as “Off Limits.” This area is adjacent to the Woodland Hills military housing with private homes on Zink and National Roads and a subdivision in the area south of the landfills. LF8 and LF10 are separated by roughly 1,000 feet with an unnamed tributary to Hebble Creek running through the area between.

Several investigations have been conducted at LF8 and LF10 including:

- Records search (1981)
- Field investigation which included the installation of monitoring wells and leachate/landfill gas wells, the sampling of surface water, leachate and groundwater and the performance of geophysical surveys (1984)
- Follow-on field investigation to install additional monitoring wells, sample new and existing groundwater wells, shallow borings to investigate landfill covers and estimate infiltration to the landfills, and monitor landfill cover borings and

leachate/landfill gas wells for hydrogen sulfide and combustible gas concentrations (1986).

Three corollary investigations were conducted during the preliminary stage of the Remedial Investigations/Feasibility Study (RI/FS) for LF8 and LF10. These included soil gas surveys, additional geophysical surveys, and a study to identify combustible gas migration from the landfills.

5.1.1 LF8

LF8 covers approximately 11 acres. It was operated from about 1947 until the early 1970s and received waste from Area B. Both general refuse and hazardous materials were disposed in the landfill using trench-and-cover methods. The total volume of waste material buried in LF8 is estimated at 187,300 cubic yards (WPAFB, 1993).

5.1.2 LF10

LF10 covers approximately 8 acres. It was operated from 1965 until the early 1970s and received waste from all areas of WPAFB. Like LF8, both general refuse and hazardous materials were disposed in LF10 using trench-and-cover methods. The total volume of waste material buried is estimated at 171,600 cubic yards (WPAFB, 1993).

An individual description of the two sites is presented in the subsequent sections.

5.2 Remedial Objectives

Significant chemical contamination was detected in LF8 and LF10 in the soil, leachate, and landfill gases. The chemicals of concern were found to be unevenly distributed throughout both landfills, which is expected from a trench-and-cover burial operation. Based on historical data and data collected during the remedial investigation, no extremely high and isolated contaminant concentrations were found that would indicate leaking buried containers or localized hazardous waste disposal areas. Furthermore, LF8 and LF10 were found to be essentially the same in terms of the types and concentrations of contaminants. This conclusion is important in that the clean-up alternative selected for the SCOU is the same at both landfills.

The overall goal of the SCOU for remedial response actions at LF8 and LF10 was to protect human health and the environment. In addition, the remedial response actions permitted

continued residential land use. The principal media and general remedial action objectives for the SCOU were as follows:

Media	General Remedial Action Objective
Soil/Landfill Contents	To prevent direct contact with and dermal absorption and ingestion of the contaminated soils and landfill contents; control surface water runoff, ponding, and erosion; to prevent or reduce infiltration and production of leachate; and to control dust emissions to meet ambient air exposure criteria.
Landfill Gas	To prevent inhalation of gases and the potential for explosion by controlling landfill gases, and to meet ambient air exposure criteria.
Leachate/Leachate Seeps	To prevent contaminants of interest in leachate from migrating to surface waters and ground waters; to prevent dermal absorption and ingestion of this leachate; and to reduce/eliminate on-site leachate generation.
Private Wells (Ground Water)	To prevent ingestion, dermal absorption, and inhalation of contaminants.

To achieve these goals, Alternative 3 from the ROD was selected for the SCOU of LF8 and LF10. Components of Alternative 3, as given in the SCOU ROD, included:

- Clay cap to limit surface water infiltration, leachate generation, landfill gas emissions, erosion, and contact with landfill contaminants.
- Leachate collection through a system of wells installed within and surrounding the landfills.
- Leachate treatment including metals removal, aerobic biological treatment, and micro-pollutant removal by carbon adsorption.
- Release of treated leachate into surface waters through National Pollution Discharge Elimination System (NPDES) permit.
- Landfill gas collection and treatment using an enclosed ground flare.
- Long term monitoring of leachate and gas collection and treatment systems.
- Public water supplied to all private homes along Zink and National Roads.
- Access restrictions including fencing, warning signs, security patrols and institutional controls (i.e., land use restrictions).

The selected remedy identified in the ROD pertaining to leachate collection and onsite treatment was later modified by an “Explanation of Significant Differences” (WPAFB, 1997a). As part of the remedial design approach for the leachate treatment system, an onsite pilot leachate treatment system evaluation program was planned and implemented. During the public notice period for the NPDES permit for the pilot leachate treatment system, representatives of the Publicly Owned Treatment Works (POTW) for the city of Fairborn contacted WPAFB and suggested that the leachate may be acceptable for treatment at the POTW. At the time of the ROD, the selected remedy did not include the POTW discharge approach because the Fairborn POTW was not consistently complying with the NPDES permit limits; CERCLA law prohibits non-compliant POTWs from accepting wastewater generated from a CERCLA site. However, since the finalization of the ROD, the Fairborn POTW had completed upgrades at the treatment plant and attained compliance with their NPDES permit.

Because the Fairborn POTW is constantly staffed and the ROD-specified onsite wastewater treatment system was not anticipated to be so, the Fairborn POTW approach would provide a level of treatment reliability comparable to or better than the onsite wastewater treatment system. In addition, capital (e.g., construction) and operating and maintenance costs were significantly reduced. Based on POTW discharge implementation considerations, such as construction, regulatory, cost, advantages and disadvantages, using the POTW for leachate treatment and disposal was decided to be optimal compared to the onsite wastewater treatment plant detailed in the ROD.

The landfill cap portion of the selected remedy identified in the ROD consisted of a low permeability (10^{-7} cm/s) clay layer. The availability of clay attaining this permeability was evaluated and presented in a Remedial Design memorandum (IT, 1994). The evaluation, based on geotechnical testing, concluded that the clay material from available sources did not meet Ohio Administrative Code (OAC) requirements. Because of the marginal quality of the clay material from the sources, the design was modified in accordance with OEPA guidance (OEPA, 1993) to allow alternate barrier layers. The alternate barrier layers consisted of a compacted clay liner and geotextiles to meet the design requirements. The system is further described in Section 5.4.1.

5.3 Current Site Conditions

LF8 and LF10 are designated for “open use” at WPAFB (Figure 5-2). Currently, both landfills are covered with low vegetation and contain monitoring wells, leachate extraction wells, and gas collection wells. LF10 is split into two areas, LF10 North and South (LF10N and LF10S), with LF10N covering approximately 285,000 sq ft and LF10S covering approximately 123,000 sq ft. WPAFB performed a preliminary evaluation for potentially using LFs 8 and 10 for recreation; however, there are no current plans to actively pursue such reuse options.

5.4 Current Remedial Systems

The current remedial system at LF8 and LF10 includes the landfill cap, landfill gas collection and treatment, and leachate collection system based on the design presented in the “Design Package Number 1 Preliminary and Prefinal Design for Landfills 8 and 10 Source Control Operable Unit Remedial Design” (IT, 1994). These systems are described in detail in the following sections.

5.4.1 LF8 and LF10 Cap System

The cap system installed at LF8 and LF10 consists of the landfill cap and the drainage system as specified by Ohio EPA regulations for sanitary landfill closure (OAC 3745-27-12) which meet requirements of RCRA, Subtitle D (40 CFR 258). Placement of this cap system reduces direct contact with on-site contaminants and minimizes on-site contamination from spreading (by diminishing rainwater infiltration and erosion).

Site preparation activities consisted of:

- Grading to a maximum slope of 4:1 and a minimum slope of 5% to promote runoff and prevent erosion
- Compaction of waste present in the trenches to reduce long-term settlement
- Removal of waste materials in trenches located outside the landfill cap boundaries.

A cross-section of the cap is shown in Figure 5-3 and includes a Geosynthetic Clay Liner coupled with a synthetic geomembrane as the primary components to minimize infiltration. A perimeter drain was installed to route infiltration through the vegetative layer to lined surface

channels. Swales convey the run-off to storm drains that discharge into the existing water courses.

Further information concerning the constructed landfill cap system is presented in the “Independent Engineer’s Certification Report for Operable Unit 1, Phase I” (IT, 1997a).

5.4.2 Landfill Gas Collection and Treatment System

The Landfill Gas Collection and Treatment Systems installed at LF8 and LF10 are designed to remove and dispose, in an environmentally sound manner, the gas generated within the landfills, and to collect the condensate produced from the gas extraction process. Installation and operation of landfill gas collection and treatment systems are necessary to comply with laws and regulations and to mitigate concerns arising from landfill gas generation. Primary concerns regarding landfill gas generation include fire, explosion, health hazards, and odor.

The landfill gas collection and treatment systems consist of the following major components:

- Vertical gas extraction wells
- Horizontal gas vent layer (HVL)
- Landfill gas collection header and piping system
- Condensate collection lines and sumps
- Extraction blower and ancillary equipment
- Flare system
- Gas barrier trench (at LF10 only).

Each of these major components is described in the *Operable Unit 1 – Landfill 8 and 10 Final Operation and Maintenance Plan* (Kelchner, 1997).

5.4.3 Leachate Collection System

The Leachate Collection System installed at LF8 and LF10 is designed to remove, in an environmentally sound manner, the leachate generated within the landfills. Installation and operation of the leachate collection system is necessary to comply with laws and regulations and to mitigate concerns arising from leachate generation and movement.

The Leachate Collection System consists of the following major components:

- Leachate collection wells (both within and along the perimeter of the landfills)

- Well pumps
- Leachate transfer system.

Each of these major components are described in the *Operable Unit 1 – Landfill 8 and 10 Final Operation and Maintenance Plan* (Kelchner, 1997).

5.5 Review of Current System Performance

5.5.1 LF8 and LF10 Cap System

The three primary concerns regarding the long-term performance of the LF8 and LF10 cover are erosion, settlement, and water ponding. This section describes the manner by which the landfills are monitored to detect and repair problems associated with these three conditions. A maintenance contractor inspects landfills, performs O&M activities, and reports on conditions in monthly status reports to WPAFB. The following sections summarized the contractors observations.

5.5.1.1 Erosion Control

Many erosion control materials are in place to help prevent or slow down the occurrences of erosion. These items are trees, bushes, berms, drainage control, and a well established turf over the entire area of LF8 and LF10. Along with natural erosion control there have also been man-made features added to help prevent erosion including perimeter ditches lined with gravel running entirely around LF10N and LF10S. LF8 has a lined perimeter ditch about two-thirds of the way around covering all sides except for the west side. The west side of LF8 has an elevation higher than the remaining sides and a double diversion ditch. Inside the three perimeter ditches there are storm drains which collect the water and distribute it to the drainage culverts. There have been no sustained erosion problems on the landfills or surrounding areas that were not readily repaired.

5.5.1.2 Settlement Monitoring

The general fill and topsoil components of LF8 and LF10 were placed and compacted in a manner designed to prevent settlement. To determine if post construction settlement has occurred, settlement monuments were installed on the landfills. A total of eight monuments were installed; three on LF8, two on LF10S, and three on LF10N (Figure 5-4 and 5-5). The

monuments were surveyed in late 1996 and again in August 1998 and showed minimal signs of settling. The average settling during the time between the two surveys is given below:

Location	1996	1998	Settlement (ft)
Landfill 8	946.80	946.63	0.17
Landfill 10S	917.15	916.78	0.38
Landfill 10N	887.35	887.24	0.11

Settlement appears to be uniform across the landfills.

5.5.1.3 Surface Water Management

The landfills and adjacent areas were graded to direct surface runoff toward the drains installed in the perimeter swale around each landfill. Surface water runoff from LF8 is ultimately discharged into the creek in the valley between LF8 and LF10S via storm drains and a rip-rap swale. Runoff from LF10N is ultimately discharged into a drainage ditch on the west side of Shields Avenue, near the intersection of Shields Avenue and Kauffman Avenue. Runoff from LF10S is ultimately discharged to the unnamed tributary between LFs 8 and 10. Down drains take runoff from the top of each landfill and divert it to the storm drain system for each landfill. Perimeter drains take the water coming off the high-density polyethylene (HDPE) liner and route it to the perimeter swales. Rip-rap was placed at the outfall of each of the perimeter drains to prevent erosion. The surface drainage system appears to be operating effectively as there have not been any noticeable water ponding on the landfills or in the areas adjacent to or between the landfills.

5.5.2 Landfill Gas Collection and Treatment System

The purpose of the OU1 explosive gas monitoring is to determine the effectiveness of the landfill gas collection system in establishing a capture zone that extends outside the landfill boundaries so that migration of explosive gas beyond the landfill boundaries is prevented (Kelchner, 1997; IT, 1998). Methane is combustible at concentrations in air between 5 percent and 15 percent. Results of the explosive gas monitoring for LF8 and LF10 are presented in the *Long-Term Groundwater Monitoring Report: April 1999* (IT, 1999b). In response to the presence of combustible gases observed in several wells during monitoring in 1998, additional monitoring points have been installed to verify the gas limits and operation procedural conditions are being

evaluated to capture this gas. The wells are located at the northern limits of LF8. Additional punchbar locations have been included around the vicinity of the well location with elevated readings. The gas does not appear to be migrating beyond the well location.

5.5.3 Leachate Collection System

The leachate collection system is monitored by measuring groundwater levels so as to evaluate the impact of the extraction system on the water levels in the vicinity of the landfills. The *Design Package Number 1, Final (100%) Design* (IT, 1994) states that “the leachate collection system shall establish a capture zone that extends outside the landfill boundaries as determined by groundwater level measurements.” These groundwater level measurements are taken quarterly and reported as part of the Long-term Groundwater Monitoring Program.

The goal of the extraction system at LF8 is to provide capture on the downgradient portion of the landfill (east and northeast sides) that prevents migration of the dilute leachate and groundwater passing through and under LF8. As the regional groundwater flow direction in this area is from west to east, the extraction wells (EWs) have been configured at the downgradient boundary to the landfill to provide the necessary capture. Figure 5-6 illustrates the potential contaminant migration paths across LF8 using particle tracking. This figure shows that wells in the central portion of LF8 (EW-0807 and EW-0810) are not providing adequate capture. To improve the capture zones of these and other extraction wells, a maintenance program, discussed below, was implemented. The effectiveness of the maintenance activities will be evaluated after subsequent water level monitoring events and particle tracking modeling.

LF10 represents a local hydrologic high where groundwater from outside the landfill does not contribute substantially to leachate generation. Therefore, the objective of the extraction system at LF10 is to maintain groundwater levels below the elevation of the bottom of the landfill in order to prevent water from mixing with the waste at the landfill. By controlling the groundwater levels, the impact of the LF10 leachate on the environment is minimized.

The effectiveness of the LF10 extraction system is evaluated by comparing the elevation of the water table to the elevation of the landfill bottom. The system is achieving the stated goal as long as the water table is below the landfill bottom. The extraction wells serve the purpose of lowering the water table rather than creating a uniform capture zone under LF10. Figure 5-7 is a cross-sectional profile along the long axis of LF10 which illustrates the variable landfill bottom

and water level elevations. The figure shows that water levels throughout the landfill can vary significantly between adjacent wells. At some locations, the extraction wells do not appear to be maintaining the water level below the bottom of the landfill material.

To increase the effectiveness of the LF8 and LF10 extraction wells, WPAFB has completed a program that included the inspection and repair of extraction wells and pumps to correct any system weaknesses. Between September 21 and November 29 1999, pumps were pulled from wells 1002, 1003, 1004, 1006, 1008,1011, 1012, 1013, 1014, 1015, 1016, 1017, 1018, 1019,1020, 1022, 1024, 1025, 1026, 0803, 0805, 0807, 0810, 0812, 0813, 0814. These wells were then surged and cleaned to remove mud and growth. Pumps were inspected, cleaned and repaired as necessary. Tabulated groundwater level measurements from November 1999 and April 1999 will be evaluated to gauge the capture efficiency of these wells following the corrective action.

5.6 Review of Current Monitoring Data

Table 5-1 summarizes the comparison of current SCOU groundwater monitoring data with groundwater compliance levels established within the SCOU ROD. Maximum detected concentrations of arsenic, beryllium, benzene, chloroform, 1,2-dichloroethene, methylene chloride, vinyl chloride, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), and 1,2,3,4,6,7,8,9-octachlorodibenzo-*p*-dioxin (OCDD) are found to exceed current compliance levels.

Additional monitoring requirements are for explosive gas emitted from gas wells. Methane is combustible at concentration in air between 5 percent [the lower explosive limit (LEL)] and 15 percent [the upper explosive limit (UEL)]. Results of the explosive gas monitoring conducted at LF8 and LF10 during November 1998, including well number, date, time and gas concentration, are presented in Tables 2-26 and 2-27 of the *Long-Term Monitoring Report: October, 1998* (IT, 1998). Methane was detected in gas samples from both LF8 (as high as 6.4 percent, which exceeds the LEL, indicating that there is sufficient methane for combustion) and LF10 (as high as 26.1 percent, which is outside the combustible concentration range of 5 to 15 percent methane). During the April 1999 monitoring event, methane was detected in 2 out of 13 locations at LF8 (as high as 18.3 percent) and 1 out of 22 locations at LF10 (as high as 57.7 percent) (IT, 1999b). These values are outside the combustible concentration range of 5 to 15 percent methane. Results from the April 1999 monitoring event are presented in Tables 5-2 and Table 5-3, respectively.

The gas barrier trench (GBT) at LF10 was always connected to the LF8 Landfill Gas (LFG) system. However, the valve connecting the GBT to the LFG systems did not allow fine tuning of the air flow balance and, when this valve was open, the flow from LF10 was so great as to cause inefficient collection of gas from LF8. Thus, this valve remained closed. However, in response to the high methane concentrations detected (at LF8-MP010), a line bypassing the existing valve and incorporating a smaller, more controllable, valve was installed on May 17, 1999 and the GBT was connected to the LFG system. Furthermore, on July 7, 1999 a methane monitor was placed in a house located near MP010 (on 7 DuPont Way). Monitoring in this house and at three new punchbar locations established around LF8-MP010 have not shown the presence of methane. Future monitoring will provide additional information about the continued efficiency of the LFG collection system. Landfill gas has not been found between the trench and the houses. The methane monitor in the residence is set to alarm at 1 % of the LEL. Since its installation the monitor has not had an alarm condition. Explosive gas monitoring readings from the three new punchbar locations were "nondetects" for methane and LEL and will be presented in the October 1999 LTM report.

5.7 Groundwater Monitoring Requirements Review

Monitoring requirements for groundwater compliance have been established within the SCOU ROD. According to Table 7: *Performance Standards for the Selected Remedy* in the ROD, the stated groundwater monitoring requirements are: Groundwater beyond the landfill boundaries will be monitored for exceedences of the maximum contaminant levels (MCLs), or preliminary remediation goals (PRGs) where MCLs are not available, for the chemicals of concern (COCs). Table 8: *Compliance Levels for the Chemicals of Concern* in the ROD lists monitoring levels for both groundwater and soil. This section discusses the basis for the current compliance levels and the rationale for proposed compliance levels.

5.7.1 Evaluation of Current Groundwater Compliance Levels

Table 5-4 provides a list of those ROD-based compliance levels. Also listed are MCLs, risk-based PRGs, and typical detection limits for the COCs. Although the original monitoring requirements as stated in Table 7 of the ROD indicate that MCLs should be considered first as the monitoring requirement for any COC, many compliance levels established in the ROD are less than either the MCL or applicable detection limits [for example, beryllium, benzene, chloroform, 1,2-dichloroethene, vinyl chloride, TCDD, and 2,3,7,8-tetrachlorodibenzofuran

(TCDF)]. In addition, although monitored, compliance levels were not established for cadmium, copper, iron, lead, zinc, cyanide, ammonia, ethyl benzene, toluene, diethylphthalate, 4-methylphenol, and naphthalene. The compliance levels listed in the SCOU ROD are final cleanup standards for OU1 groundwater. Groundwater modeling under the BMP indicates that it may take up to 60 years to accomplish these goals. Even though the groundwater standards have not yet been met, the selected remedy for groundwater remains protective. Residents with private wells within the area were connected to a public water supply, and no new wells can be installed within this area.

With few exceptions, (methylene chloride and dioxins other than TCDD) MCLs are available for most COCs for which compliance levels were established. In the absence of an MCL, the PRG can be utilized as an appropriate compliance level. The exception is 2,3,7,8-TCDF (PRG is less than the detection limit) where the detection limit can be used as the compliance level. It should also be noted that risk-based compliance levels had been established for 1,2,3,4,6,7,8-heptachlorinated dibenzo-*p*-dioxin (HpCDD); 1,2,3,4,6,7,8-heptachlorinated dibenzofuran (HpCDF); and 1,2,3,4,6,7,8-hexachlorinated dibenzo-*p*-dioxin (HxCDD). However, according to USEPA (1989) these congeners possess minimal, if any, toxicity. USEPA has, therefore, not assigned toxicity to these compounds. Risk-based compliance levels can not be determined for these congeners and should not be included in the compliance monitoring list of chemicals.

The risk-based compliance level listed in the ROD for trans-1,2-dichloroethene is $6.77 \times 10^{-2} \mu\text{g/L}$. However, $6.77 \times 10^{-2} \mu\text{g/L}$ was referenced in 1993 by U.S. EPA as the PRG for 1,1-dichloroethene, not trans-1,2-dichloroethene (USEPA, 1993). The correct PRG in 1993 for trans-1,2-dichloroethene was $150 \mu\text{g/L}$; currently the PRG is estimated by USEPA at $120 \mu\text{g/L}$ (USEPA, 1999). In 1993 (and also currently active as a regulatory value), USEPA had established an MCL for trans-1,2-dichloroethene of $100 \mu\text{g/L}$. The compliance concentration for trans-1,2-dichloroethene should be the $100 \mu\text{g/L}$ MCL.

5.7.2 Evaluation of Detected Constituent Concentrations in Groundwater

Table 5-1 provides a comparison of maximum detected constituent concentrations from recent compliance monitoring with current compliance levels. Compliance levels that have been exceeded by detected constituent concentrations have been identified. Constituents found to exceed proposed compliance levels are arsenic, beryllium, benzene, methylene chloride, vinyl

chloride, and OCDD. Compliance levels will be reevaluated and, if a change is considered appropriate, an Explanation of Significant Differences (ESD) will be prepared for this ROD.

5.8 ARARs Review

The purpose of this review is to determine whether recently promulgated or modified requirements of federal or State of Ohio environmental regulations are applicable or relevant and appropriate, and if modifications of regulations during the past five years call into question the protectiveness of the remedy (EPA, 1995). The following sections summarize the status of Applicable or Relevant and Appropriate Requirements (ARARs) that were established for the selected remedy to protect human health and the environment.

5.8.1 Location-Specific ARARs

No location-specific ARARs were established in the ROD. There have been no changes to the characteristics of this site that would prompt the establishment of additional ARARs. Furthermore, no other applicable or relevant and appropriate requirements that would apply to the site location were promulgated during the five-year review period.

5.8.2 Action-Specific ARARs

The primary activities of the remedy were evaluated with respect to action-specific ARARs. These components were described in the ROD (WPAFB, 1993) as follows:

- Low Permeability Cap
- Leachate Collection and Treatment
- Landfill Gas Collection and Treatment
- Public Water Supply for Private Well Users
- Operation and Maintenance and Performance Monitoring
- Disposal of Nonhazardous Drill Cuttings under the Clay Cap.

The following ARARS were established for the purpose of site closure:

- OAC 3745-27-11, Final Closure of Sanitary Landfills
- OAC 3745-27-14, Post-Closure Care of Sanitary Landfills
- 40 CFR 258.61, Criteria for Municipal Solid Waste Landfills.

Criteria that address the design of the facility have already been met; regulations for post-closure care remain in effect.

Several of the ARARs established in the ROD concerned permits. Two of these ARARs, OAC 3745-31, Permit to Install New Sources and OAC 3745-35, Air Permits to Operate and Variances were applicable to the modification of solid waste disposal facilities. Under the NCP, remedial activities occurring onsite are required to meet the substantive requirements, but not the administrative requirements. However, permits for remedial activities were required under Section 9B of the Administrative Orders of Consent between OEPA and WPAFB (WPAFB, 1993), permits were not issued because this source is considered to be de minimus by the Regional Air Pollution Control Agency.

Fugitive dust emissions were addressed in the ROD under OAC 3745-17-08, Restrictions on Emissions of Fugitive Dusts. Although this ARAR was relevant and appropriate during capping operations, it remains in effect because the cap is intended to continue as a means of dust emissions control. Landfill post-closure care includes monitoring and maintenance of the cap, including the vegetative cover. A related ARAR, OAC 3745-15-07, Air Pollution Nuisances Prohibited is still relevant and appropriate due to landfill gas production.

Permits for general construction and best management practices for erosion and stormwater runoff controls were required because over five acres of the site were affected. Permit requirements were specified in:

- 40 CFR 122, National Pollutant Discharge Elimination System
- OAC 3745-38, Ohio NPDES General Permits
- 40 CFR 122.44, National Pollutant Discharge Elimination System – Establish Limitations, Standards, and Other Permit Conditions
- 40 CFR 125, Criteria and Standards for the National Pollutant Discharge Elimination System
- OAC 3745-32-02, Section 401 Water Quality Certification Required
- OAC 3745-33-02, Ohio NPDES Permits Required
- OAC 3745-33-02, Ohio NPDES Permits – General Permit Conditions
- OAC 3745-33-02, Ohio NPDES Permits – Criteria for Issuing Permits

- ORC 6111.04.2, Regulations Requiring Compliance with National Effluent Standards

At OEPA's request, WPAFB applied in 1998 for an individual NPDES permit renewal for stormwater discharges from the State of Ohio. Discharges at OU-1 would be subject to this base-wide permit. Response to this application is pending.

The selected remedy identified in the ROD included leachate collection and onsite treatment. As part of the remedial design approach for the onsite leachate treatment system, an onsite pilot leachate treatment system evaluation program was planned and implemented. At the time of the ROD, the selected remedy did not include a POTW discharge approach because the Fairborn POTW was not consistently complying with NPDES permit limits. CERCLA prohibits non-compliant POTWs from accepting wastewater generated from a CERCLA site. Since that time, the Fairborn POTW has completed upgrades at the treatment plant and attained compliance with their NPDES permit (WPAFB, 1997a). WPAFB prepared a permit-to-install for the discharge line to the Fairborn sanitary sewer system.

An Explanation of Significant Differences (ESD) was prepared to document this new information and describe modifications to the leachate collection and treatment process for the site (WPAFB, 1997a). These modifications consisted of construction and maintenance of a leachate direct discharge line to the Fairborn sanitary sewer system for treatment at the POTW. Under the Clean Water Act, Section 307 (b), general pretreatment regulations are intended to control the introduction of pollutants into POTWs. Federal and state of Ohio ARARs address conditions for such discharges:

- 40 CFR 403.5, General and Specific Prohibitions on Discharges to POTWs
- OAC 3745-3-04, Prohibited Discharges
- OAC 7345-3-05, Notification of Potential Problems Including Slug Load

In addition, wastes/residues (activated sludge, activated carbon) were no longer generated from the leachate treatment system, so disposal of these materials was not required. Therefore, ARARs for hazardous waste determination, transport or disposal are not applicable or relevant and appropriate. However, requirements for hazardous waste management remain in effect.

As part of the post-closure of these landfills, a ground water monitoring program was instituted under the ROD and continues to be subject to OAC 3745-27-10. The monitoring criteria for constituents of concern at the site are listed and discussed in Section 5.6.

Due to methane gas production from the landfill, the site is monitored for explosive gases under OAC 3745-27-12, Explosive Gas Monitoring and ORC 3734.04.01, Explosive Gas Monitoring Plan for Sanitary Landfill; Evaluation of Threat; Abatement Order; Inspections; Rules.

5.8.3 Chemical-Specific ARARs

Chemical-specific ARARs are specified for purposes of the groundwater monitoring program. For most constituents, the MCLs under 40 CFR 141, Safe Drinking Water Act are relevant and appropriate. For chemicals that do not have MCLs, risk-based concentrations or detection limits have been recommended. For purposes of this ROD review, the criteria for the monitoring program were evaluated and updated. These criteria are discussed in further detail in Section 5.7 of this document.

Chemical-specific ambient water quality standards (OAC 3745-1) no longer apply because the remedy does not involve a point-source discharge to surface water. As stated in the above paragraphs, landfill leachate is directly discharged to the Fairborn POTW (WPAFB, 1997a).

5.9 Recommendations

Compliance levels that have been exceeded by detected constituent concentrations have been identified. Therefore, it is recommended that groundwater monitoring be continued. However, it is also recommended that alternate groundwater compliance levels be used to evaluate future groundwater constituent concentrations in light of the information presented in Section 5.7. These compliance levels will be reevaluated and, if a change is considered appropriate, an ESD will be prepared for this ROD.

In addition, monitoring of explosive landfill gas should be continued. The evaluation of these data ensure that the landfill is performing optimally. Monitoring of landfill erosion and settlement and groundwater elevation should also be continued.

6.0 Off-Source Operable Unit ROD

6.1 Site Characteristics

The Off-Source Operable Unit (OSO) ROD (WPAFB, 1994) contains a portion of the overall remediation of Landfills 8 and 10 (LF8 and LF10). In particular, OSOU is comprised of areas outside but potentially affected by LF8 and LF10. The information provided was obtained from the ROD for the OSOU.

LF8 and LF10 are located in the northeast corner of Area B at WPAFB, in the area bounded by National, Kaufman, and Zink Roads (Figure 6-1). Currently, the entire area encompassing the landfills is fenced and posted as "Off Limits." This area is adjacent to the Woodland Hills military housing with private homes on Zink and National Roads and a subdivision in the area south of the landfills. LF8 and LF10 are separated by roughly 1,000 feet with an unnamed tributary to Hebble Creek running through the area between.

Several investigations were conducted at LF8 and LF10 including:

- Records search (1981)
- Field investigation which included the installation of monitoring wells and leachate/landfill gas wells, the sampling of surface water, leachate and groundwater and the performance of geophysical surveys (1984)
- Follow-on field investigation to install additional monitoring wells, sample new and existing groundwater wells, shallow borings to investigate landfill covers and estimate infiltration to the landfills, and monitor landfill cover borings and leachate/landfill gas wells for hydrogen sulfide and combustible gas concentrations (1986).

Three corollary investigations were conducted during the preliminary stage of the RI/FS for LF8 and LF10. These included soil gas surveys, additional geophysical surveys, and a study to identify combustible gas migration from the landfills.

An individual description of the two sites is presented in the following sections.

6.1.1 LF8

LF8 covers approximately 11 acres. It was operated from about 1947 until the early 1970s and received waste from Area B. Both general refuse and hazardous materials were disposed in the landfill using trench-and-cover methods. The total volume of waste material buried in LF8 is estimated at 187,300 cubic yards (WPAFB, 1994).

6.1.2 LF10

LF10 covers approximately 8 acres. It was operated from 1965 until the early 1970s and received waste from all areas of WPAFB. Like LF8, both general refuse and hazardous materials were disposed in LF10 using trench-and-cover methods. The total volume of waste material buried is estimated at 171,600 cubic yards (WPAFB, 1994).

6.2 Remedial Objectives

Cleanup goals for the site as a whole were to prevent direct contact with on-site contaminants, to prevent on-site contamination from spreading, to capture contaminated groundwater that has already migrated from the site, and to eliminate the potential exposure to site-related contaminants during use of private water sources for drinking and showering. There were no remedial objectives selected for the OSOU in particular. In the ROD for the OSOU, the “No Action” alternative was selected as remedy for this site (i.e., the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites). This selection was based on several factors:

1. No new pathways of exposure presenting a risk were identified in the Off-Source RI Report which had not already been identified during the previous Focused RI, precluding the need for any additional feasibility studies.
2. The previously approved Source Control remedial action was comprehensive and eliminated all exposure pathways where a risk was identified.
3. Migration of contaminants beyond the boundaries of the landfills was found to be limited and contaminants were present at relatively low levels.

6.3 Current Site Conditions

As discussed in Section 6.2, the No Action alternative was selected as the remedy for the OSOU. This was based, in part, on the determination that the previously approved SCOU remedial action was comprehensive and eliminated all exposure pathways where a risk was identified. The

SCOU ROD, however, explicitly stated that downgradient groundwater (i.e., groundwater already affected by LF8 and LF10) is not addressed by the SCOU ROD and that “the clean-up of ground water already affected by the site will be addressed, if necessary, by an off-source remediation effort...” Any necessary remedial actions to groundwater downgradient of LF8 and LF10 will be determined through this program as a result of future monitoring efforts.

Groundwater monitoring data downgradient from LF8 and LF10, however, is collected annually as part of the Basewide Long-Term Monitoring (LTM) program. Monitoring well locations and results of the most recent sampling event (October 1998) are presented in Figures 6-2 through 6-4. Arsenic, vinyl chloride and 2,3,7,8-TCDD are above MCLs in groundwater downgradient from LF8. No chemical constituents are above MCLs in groundwater downgradient from LF10.

6.4 Recommendations

Based, in part, on the assumption that the SCOU ROD was comprehensive and eliminated all exposure pathways where risk was identified, the remedy selected for the OSOU was No Action. However, the SCOU does not address groundwater that had already migrated away from the landfills. Downgradient groundwater monitoring data, however, is collected as part of the Basewide Long-Term Monitoring Program. The most recent data collected shows that groundwater downgradient from LF10 is limited and contaminants are present in relatively low levels as stated in the OSOU ROD (see Section 6.2). Downgradient groundwater from LF8, however, contains several contaminants detected at concentrations above MCLs. The remedy for groundwater at the OSOU remains protective since residents with private wells within this area were connected to a public water supply and no new wells can be installed in this area. It is recommended that groundwater downgradient from LF8 continue to be monitored under the LTM program. Any necessary remedial actions to groundwater downgradient of LF8 will be determined through this program as a result of future monitoring efforts.

7.0 Spill Sites 2, 3, and 10 (Operable Unit 2) ROD

7.1 Site Characteristics

The Operable Unit 2 (OU2) ROD (WPAFB, 1997b) is comprised of the subsurface soil and groundwater at OU2 Spill Sites 2, 3, and 10 (SP2, SP3, and SP10) in the Petroleum, Oil, and Lubricants (POL) Area vicinity at WPAFB (Figure 7-1). Historically, the OU2 POL Storage Area was used to store heating, automotive, and jet fuel products. The petroleum products were transferred to fueling stations or other areas of the base through a network of underground pipes and valves which have since been abandoned in place and replaced with aboveground piping. Specific site descriptions and histories are presented in the following sections.

Several investigations were conducted at the OU2 POL Storage Area vicinity including:

- A removal action began in March 1991 consisting of installing two piezometers to investigate the nature of contamination in the POL Storage Area vicinity, installing a skimmer pump in Monitoring Well 04-518-M, and providing a 1,000-gallon aboveground tank to hold fuel recovered from the well. Approximately 1,600 gal of petroleum product were recovered through April 1995 as a result of this removal action.
- A second recovery well system including an oil/water separator, product storage tank, equalization tank, air stripper, vapor-phase carbon filters, and a water-filtration unit began operation in May 1993. About 82 gallons of free product had been recovered through March 1995. The aboveground treatment system for this recovery well was destroyed by fire in November 1995. Because results of the RI indicated no appreciable free product existed in this area and only minimal amounts were collected during the 18 months of operation, there are no plans to rebuild this system.
- A third removal action began in September 1993 with the addition of a Petro Trap passive recovery system in Monitoring Well WP-NEA-MW21-3S. The Petro Trap is a skimmer system that collects floating product from the well and retains it internally until it is emptied manually. Approximately 5 gallons of free product has been removed by this system.
- A bioventing application evaluation study was initiated in March 1993 to address petroleum hydrocarbons contaminating the soil in the POL Storage Area vicinity. The study included measuring the unsaturated soil system's ability to naturally degrade petroleum hydrocarbons. Air was forced into the subsurface soil to enhance natural degradation activity. Based on this study, a pilot bioventing system was installed and

operated from June 1993 to May 1994 to demonstrate the viability of soil bioventing at OU2.

7.1.1 SP2

SP2 is located within the POL Storage Area, approximately 200 ft inside the WPAFB east boundary. This site is associated with the release of approximately 8,300 gal of JP-4 jet fuel from Tank 256 in April 1976. The spill occurred within a diked area surrounding the tank. The wells in both the North Well Field and the West Park Well Field were on reserve status at that time. Cleanup conducted at the time of the spill included the installation of three recovery wells installed adjacent to Tank 256 which recovered approximately 4,800 gal of spilled jet fuel.

7.1.2 SP3

SP3 is located within the POL Storage Area, approximately 400 ft inside the WPAFB east boundary. This site involved the release of 1,200 to 2,500 gallons of No. 2 fuel oil from Tank 272 in March 1981. The spill occurred between Tank 272 and the fueling station. Cleanup conducted at the time of the spill included the installation of a recovery trench adjacent to the spill but no fuel oil was recovered.

7.1.3 SP10

SP10 is approximately 600 ft southwest of the POL Storage Area and 1,400 ft inside the WPAFB east boundary. The spill at Site 10 occurred in October 1989 when a flange gasket ruptured on a JP-4 hydrant and released an estimated 150 gallons of fuel. This site is surfaced with limestone gravel and asphalt; at the time of the fuel spill, the site was grass covered. Cleanup at the time of the spill involved the use of absorbent materials to recover about 10% of the spilled jet fuel.

7.2 Remedial Objectives

Contaminants found at SP2, 3, and 10 in the POL Storage Area vicinity are those generally associated with petroleum storage areas; namely, benzene, toluene, ethylbenzene, and xylenes (BTEX), semivolatile organic compounds (SVOCs) called polycyclic aromatic hydrocarbons (PAHs), and some metals. However, the results of the screening process indicated that benzene in groundwater and BTEX in subsurface soil were the only contaminants that required remediation.

The goal of the remedial action for subsurface soil was to reduce the BTEX contamination to levels below the criteria set by the State of Ohio's Bureau of Underground Storage Tank Regulations (BUSTR). OAC 1301:7-9-13 for Underground Storage Tanks (USTs), the BUSTR regulations, was revised in 1998 and became effective on March 31, 1999. As part of the revisions to these regulations, the action levels for protection of human health were expanded to address specific exposure pathways. Although actions prior to March 31, 1999 are not required to follow the new rule, the new action levels were reviewed with respect to the action levels cited in the OU2 ROD.

For soils, action levels established for OU2 per the 1992 rule were compared with the most protective action level under the 1999 rule (OAC 1301:7-9-13) for each chemical of concern. As shown in the following table, the action levels for benzene are nearly equal. The action levels established in the ROD for the remaining compounds are more protective than those provided under the 1999 rule.

Comparison of BUSTR Action Levels in Soil

Chemical of Concern	Action Level (OU2 ROD) (mg/kg)	Action Level (1999 BUSTR) (mg/kg)
Benzene	0.17	0.15
Toluene	7	58.7
Ethylbenzene	10	71.1
Xylene	47	1500

For groundwater, the MCL of 0.005 mg/L was established as the ARAR for benzene. There has been no change to the MCL for benzene during the five-year review period.

To achieve these goals, Alternative GW2A was selected for OU2 remediation. A description of Alternative GW2A as given in the OU2 ROD is as follows:

Use of natural processes, institutional controls, and monitoring to address contamination of groundwater and subsurface soil. Components of this alternative are:

- In situ biodegradation of subsurface soil
- Natural attenuation of groundwater
- O&M of existing removal actions
- Institutional controls
- Subsurface soil and groundwater monitoring.

O&M of existing removal actions has continued. Institutional controls such as fences and deed restriction have ensured access to the site is restricted and future land use is appropriate. Subsurface soil gas and groundwater monitoring are evaluating the performance of in situ biodegradation and natural attenuation and provide the data needed to verify the effectiveness of the alternative to meet remedial action objectives for subsurface soils and groundwater. The effectiveness of the alternative will be evaluated under the BMP. Monitoring will continue for 3 years after cleanup goals are achieved.

7.3 Current Site Conditions

There are currently three passive remediation processes ongoing at OU2. The passive collection absorbent pad placed in monitoring well WP-NEA-MW21-3S is still in place; however, the accumulation of product has been negligible. Also, a belt skimmer placed in monitoring well 04-518-M is still in place. Otherwise, natural attenuation is being utilized as the primary remediation for the site. This area is designated for “industrial use” at WPAFB (Figure 7-2).

7.4 Current Remedial Systems

Natural attenuation, also known as passive bioremediation, intrinsic bioremediation, or intrinsic remediation, is a passive remedial approach that depends upon natural processes to degrade and dissipate petroleum constituents in soil and groundwater. Some of the processes involved in natural attenuation of petroleum products include aerobic and anaerobic biodegradation, dispersion, volatilization, and adsorption. In general, for petroleum hydrocarbons, biodegradation is the most important natural attenuation mechanism; it is the only natural process that results in an actual reduction of petroleum constituent mass.

In accordance with the ROD and remedial alternative GW2A for SP2, 3, and 10 within OU2, a long-term soil, gas and groundwater monitoring program was initiated for this area. The

monitoring program includes the baseline evaluation, conducted in May 1997, and biannual groundwater and soil gas sampling and analysis. The objectives of this monitoring program are to evaluate the effectiveness of the in-situ biodegradation and natural attenuation processes on petroleum hydrocarbon contamination in the soil and groundwater.

In addition, free-product continues to be removed from monitoring well NEA-MW21-3S. This well has consistently had an approximately 0.01-inch thick layer of petroleum hydrocarbon product on the groundwater surface. Beginning in June 1999, a SoakEase[®] hydrocarbon absorbent pad was installed in NEA-MW21-3S. Since its installation the SoakEase[®] has been replaced every two to three weeks with an average of approximately 24 ounces of product being removed with each pad.

7.5 Review of Current System Performance

As discussed in Section 7.3 and 7.4, the current system at OU2 for groundwater and soil remediation consists of natural attenuation of groundwater, in-situ biodegradation of soil contaminants, and the use of oil absorbent pads or skimmers in two wells (04-518-M and NEA-MW213S).

Although a rigorous evaluation of whether natural attenuation was occurring at OU2 was not conducted, the groundwater data was evaluated to determine if BTEX concentrations were decreasing and was also evaluated to determine if groundwater contaminants were migrating. A statistical evaluation of soil concentrations was not possible and therefore not performed.

To determine if BTEX concentrations were decreasing, historical monitoring data from OU2 for benzene and BTEX were analyzed using the Mann-Kendall Test for Trend. The Mann-Kendall Test for Trend is a non-parametric statistical test that sequentially ranks the change in concentration from one sample event to the next. The test was designed for the analysis of data collected at several time points. Because this is a ranking test, the method allows the inclusion of “non-detects” and it is unaffected by missing data. Eleven wells were evaluated using available data collected over the past 7 years. Table 7-1 provides a summary of the statistical test and indicates the probability of a decreasing or increasing trend.

Three wells, OW-2, OW-4, and P11-1, were free of benzene and BTEX during the entire evaluation period. The statistical evaluation indicated that benzene and total BTEX were decreasing in seven wells (04-016-M, 04-518-M, OW-1, P18-1, P18-2, NEA-MW20-2S, and NEA-MW28-5S). The probability was greater than 80 percent that benzene concentrations were decreasing in six of these wells. The probability of a decreasing benzene trend was only 50 percent for 04-518-M. This probability indicates very low confidence that the concentration is actually decreasing. This is supported by the analytical data that indicates concentrations of contaminants generally increased during the last sampling event in 04-518-M. Only one well (OW-3) had data that suggested an increasing concentration of dissolved benzene and BTEX. The probability of an increasing trend in OW-3 is 76 percent. However, the data indicated that the concentration of benzene in OW-3 is low and variable. The concentration appears stable based on the results of the Test for Trend.

The data was also evaluated to determine if trends were apparent that would indicate the contaminants in groundwater were migrating. This was done by comparing contaminant concentrations, with time, along a downgradient vector. In general, there is little evidence to indicate that contaminants are migrating. Contaminant concentrations in the downgradient wells, with the exception of well OW-3, are decreasing or staying stable in the wells that were sampled. However, the most current monitoring report (IT, 1999d) indicates that an additional downgradient well (OW-6) is recommended for sampling during the next monitoring period.

7.6 Review of Current Monitoring Data

Groundwater - Benzene is the only analytical constituent identified in the ROD as a monitored constituent in groundwater with a compliance concentration equal to the MCL of 5 $\mu\text{g/L}$. In a recent monitoring report: *OU2 Long-Term Monitoring Round 4 Sampling Results - April 1999* (IT, 1999d), benzene concentrations in OU2 groundwater were reported. Table 7-2 provides a comparison of recent data from April 1999 to maximum detected concentration in previous monitoring efforts. Benzene concentrations are shown to decrease from a maximum of free product (Well No. NEA-MW21-3S, 5/22/97) to 240 $\mu\text{g/L}$ in the same well in 1999. Current concentration isopleth estimates are shown in Figure 7-3. Concentrations of benzene have clearly decreased, however, the concentration remains above the 5 $\mu\text{g/L}$ MCL.

Soil – BTEX concentrations have been monitored in soil using soil gas measurements. Soil gas measurements from May 1997 (OU2 baseline sampling event) and April 1999 are illustrated in Figure 7-4 and show a general decrease in the size of the vapor plume. In addition, two soil samples were collected at depth intervals of 5.5 to 6.5 feet and 7 to 8 feet during the Baseline Investigation (IT, 1997b). BTEX was below detection limits in the 5.5 to 6.5 foot sample while xylene was the only detected constituent ($5.3 \mu\text{g/kg}$) in the 7 to 8 foot sample. The remediation goals established in the ROD for OU2 subsurface soil are based on criteria set by BUSTR. These levels are: 0.17 mg/kg benzene, 10 mg/kg ethylbenzene, 7 mg/kg toluene, and 47 mg/kg xylene.

Natural Attenuation

There are a number of parameters that can be used as indicators of the natural attenuation of hydrocarbons in groundwater. The primary indicator of natural attenuation is to define the physical characteristics of the plume as stable, shrinking or expanding. In general, a shrinking or stable plume is strong evidence that natural attenuation is effectively remediating a site (ASTM, 1998). Figure 7-3 presents the current benzene concentrations in groundwater (April 1999) and the initial RI benzene concentrations (1991-1992). As seen in the figure the benzene plume has been reduced in both size and concentration from the RI sampling.

The secondary line of evidence of natural attenuation are the indicators of biodegradation. Biodegradation is the process in which naturally occurring subsurface microorganisms biodegrade contaminants, often completely degrading hydrocarbons to carbon dioxide and water. The transformation of hydrocarbons into these end products occurs through a series of oxidative reactions. For the process to be complete an electron acceptor is required. Typically, this electron acceptor is molecular oxygen and the process is called aerobic respiration. In the absence or near absence of molecular oxygen and in the order presented, nitrate, manganese (as Mn II), ferric iron, sulfate or carbon dioxide may serve, if available, as terminal electron acceptors in an anaerobic respiration. In this sequence of biodegradation ferric iron becomes ferrous iron (Fe II). The expected relationship between BTEX concentration and the concentration of a particular electron acceptor or its reduction product is summarized below:

BTEX	Oxygen	Nitrate	Mn (II)	Fe (II)	Sulfate
High	Low	Low	High	High	Low
Low	High	High	Low	Low	High
827 µg/L ⁽¹⁾	1.19 mg/L	ND	NA	4.68 mg/L	ND

⁽¹⁾Well 04-518-M, April 1999

µg/L - micrograms per liter

mg/L - milligrams per liter

ND - Not detected

NA - Not analyzed

The BTEX concentrations for well 04-518-M were the highest detected during the April 1999 sampling event and are presented for an example. As seen in the table, the concentrations of the biodegradation indicators for monitoring well 04-518-M match the correlation given for high BTEX concentrations in groundwater when natural attenuation is reducing hydrocarbons.

7.7 Areas of Noncompliance

Figure 7-4 describes the OU2 area and delineates the benzene soil gas plume during the baseline monitoring period (May 1997) and compares it to the benzene soil gas plume in April 1999. Although the soil gas plume has decreased in concentration over the two year period, it is unclear if the remediation goals established for subsurface soil have yet been met since there is no direct correlation between soil gas and soil constituent concentration.

Benzene has been recently detected in groundwater at concentrations that range to 240 µg/L (Table 7-2) which indicates that benzene groundwater concentrations remain above the 5µg/L MCL.

7.8 ARARs Review

The purpose of this review is to determine whether recently promulgated or modified requirements of federal or state of Ohio environmental regulations are applicable or relevant and appropriate, and if modifications of regulations during the past five years call into question the protectiveness of the remedy (EPA, 1995). The following section summarizes the status of ARARs that were established for the selected remedy to protect human health and the environment.

ARARs were evaluated with respect to the elements of the selected remedy (GW2A) as described in the ROD (WPAFB, 1997b) for Spill Sites 2, 3, and 10:

- In situ Biodegradation of Contaminants in Subsurface Soil
- Natural Attenuation of Contaminants in Groundwater
- Operations/Maintenance of Existing Recovery Systems
- Institutional Controls
- Subsurface Soil and Groundwater Monitoring

No location-specific or action-specific ARARs were established for the selected remedy in the ROD (WPAFB, 1997b). There have been no ARARs promulgated since the ROD that would warrant additional location-specific ARARs at this time. Similarly, no new action-specific ARARs pertaining to remedial activities have been identified for this remedy.

The remediation of contaminants in subsurface soil and groundwater was addressed under chemical-specific ARARs. The goal of the remediation for subsurface soil is to reduce BTEX contamination (i.e., benzene, toluene, ethylbenzene, and xylene) to levels below the criteria set by BUSTR. At the time the ROD became effective, the action levels identified under BUSTR (OAC 1301:7-9-13) were: benzene [0.17 milligrams per kilogram (mg/kg)]; toluene (7 mg/kg); ethylbenzene (10 mg/kg); and total xylenes (47 mg/kg). Revisions to OAC 1301:7-9-13, known as New Rule 13, became effective on March 31, 1999. New action levels have been defined for BTEX compounds under a variety of site assumptions.

During the five-year review period, the groundwater plume and the associated subsurface soils have been monitored using soil gas analyses, as described in Section 7.6 of this document. However, it is not possible to estimate actual soil concentrations on the basis of soil gas data. Baseline soil samples were collected and analyzed at the inception of this monitoring program. To compare concentrations of BTEX in subsurface soil to the more recent action levels and conditions, confirmatory soil samples are recommended in Section 7.9.

The goal of the remedial action for groundwater is to reduce benzene contamination to below the MCL, as specified under 40 CFR 141, Safe Drinking Water Act. The MCL was 0.005 milligrams per liter (mg/L) at the time the ROD was finalized and has not been revised during the five-year review period. This value is consistent with the MCL for benzene under OAC

3745-81, 82, Ohio Drinking Water Rules and the action level for benzene in groundwater under BUSTR 1301:7-9-13.

7.9 Recommendations

Benzene in groundwater remains above the MCL in locations identified in Figure 7-3. It is recommended that benzene monitoring be continued until groundwater concentrations can be found to be less than the MCL. However, soil sampling data indicate the potential for BETX to be below the established remediation goals. It is recommended that subsurface soil samples be collected and compared against remediation goals. If BETX concentrations are found to be less than remediation goals, further soil gas monitoring would not be required.

8.0 Summary of Recommendations

8.1 21 No Action Sites

Based on a review of current land use restrictions at the 21 No Action sites, no changes in the selected remedy are recommended. The No Action alternative remains effective as protective of public health and the environment; current land use restrictions remain in place and there is no current exposure to the subsurface contamination.

8.2 41 No Action Sites

Based on a review of current land use restrictions at the 41 No Action sites, no changes in the selected remedy are recommended. The No Action alternative remains effective as protective of public health and the environment; current land use restrictions remain in place and there is no current exposure to the subsurface contamination.

8.3 Source Control Operable Unit

Compliance levels that have been exceeded by detected constituent concentrations have been identified. Therefore, it is recommended that groundwater monitoring be continued. However, it is also recommended that alternate groundwater compliance levels be used to evaluate future groundwater constituent concentrations in light of the information presented in Section 5.7. Compliance levels will be reevaluated and, if a change is considered appropriate, an ESD will be prepared for this ROD. In addition, monitoring of explosive landfill gas should be continued. The evaluation of these data ensure that the landfill is performing optimally. Monitoring of landfill erosion and settlement and groundwater elevations should also be continued.

8.4 Off-Source Operable Unit

Based, in part, on the assumption that the SCOU ROD was comprehensive and eliminated all exposure pathways where risk was identified, the remedy selected for the OSOU was No Action. However, the SCOU does not address groundwater that had already migrated away from the landfills. Downgradient groundwater monitoring data, however, is collected as part of the Basewide Long-Term Monitoring Program. The most recent data collected shows that groundwater downgradient from LF10 is limited and contaminants are present in relatively low levels as stated in the OSOU ROD (see Section 6.2). Downgradient groundwater from LF8, however, contains several contaminants detected at concentrations above MCLs. It is therefore

recommended that downgradient groundwater from LF8 continue to be monitored under the LTM program. Any necessary remedial actions to groundwater downgradient of LF8 will be determined through this program as a result of future monitoring efforts.

8.5 Spill Sites 2, 3, and 10 (Operable Unit 2)

Benzene remains above the MCL in locations identified in Figure 7-3. It is recommended that benzene monitoring be continued until groundwater concentrations can be found to be less than the MCL. However, soil gas monitoring data indicate the potential for BETX to be below the established remediation goals. It is recommended that subsurface soil samples be collected and compared with remediation goals. If BETX concentrations are found to be less than remediation goals, further soil gas monitoring would not be required.

8.6 Implementation Schedule

The collection and evaluation of data for possible revisions to the SCOU and OSOU RODs will be a continuing process. The goal of this process is to derive the most effective remedies possible for the continued protection of human health and the environment. The anticipated schedule for activities in the immediate future is as follows:

April 00	Collect groundwater data from LFs 8 & 10 during routine groundwater sampling event.
April 00 – May 00	Review groundwater data from LFs 8 & 10 to evaluate capture zones. Establish compliance points for the SCOU and evaluate analytical parameters and compliance levels for SCOU and OSOU.

The OU2 ROD will also be reviewed in April 00 to evaluate the need for continued soil gas sampling or explore the possibility that such sampling can be terminated (as allowed by the ROD).

9.0 Statement of Protectiveness

9.1 21 No Action Sites ROD

The remedy selected for the 21 No Action sites was based on the assumption that land use restrictions would remain in place. Based on a review of current land use restrictions (which remain unchanged since the issuance of the ROD), it has been determined that the remedies selected for these 21 No Action sites remain protective of human health and the environment.

9.2 41 No Action Sites ROD

The remedy selected for the 41 No Action sites was based on the assumption that land use restrictions would remain in place. Based on a review of current land use restrictions (which remain unchanged since the issuance of the ROD), it has been determined that the remedies selected for these 41 No Action sites remain protective of human health and the environment.

9.3 Source Control Operable Unit ROD

Based on a review of the most recent monitoring data, several contaminants have remained above current compliance levels and methane has been detected in some wells. Although the selected remedies for the SCOU have not yet achieved the ROD compliance levels as of this first 5-year review, these remedies continue to be protective of human health and the environment. However, the plans outlined herein are designed to achieve these goals. WPAFB is taking steps, as noted in Section 5.9, to ensure that the selected remedies remain protective.

9.4 Off-Source Operable Unit ROD

Selection of the No Action alternative for the OSOU was based, in part, on 1) the determination that the previously approved SCOU remedial action was comprehensive and eliminated all exposure pathways where a risk was identified, and 2) contaminants that had migrated away from the landfills were present at relatively low levels. The SCOU ROD, however, explicitly stated that downgradient groundwater (i.e., groundwater already affected by LF8 and LF10) is not addressed by the SCOU ROD and that “the clean-up of ground water already affected by the site will be addressed, if necessary, by an off-source remediation effort...”. In addition, recent downgradient groundwater monitoring data show several constituents above MCLs. As noted in Section 6.4, however, WPAFB is monitoring this downgradient groundwater as part of the LTM

program and any necessary remedial actions will be determined through this program. The remedy for groundwater at the OSOU remains protective since residents with private wells within the area were connected to a public water supply and no new wells can be installed within this area.

9.5 Spill Sites 2, 3, and 10 (OU2) ROD

Based on a review of current monitoring data, benzene at OU2 continues to decrease in general sitewide; however, benzene concentrations remain above the MCL at several locations. Although the selected remedies for OU2 have not yet achieved the benzene MCL as of this first 5-year review, these remedies are ongoing and continue to be protective of human health and the environment. This indicates that the selected remedy is working and continued implementation is necessary to achieve the final cleanup goals specified in the ROD. WPAFB is taking steps, as noted in Section 7.9, to ensure that the remedy is protective.

9.6 Signature

William E. Muno
Director, Superfund Division

Date

10.0 Next Review

The next review for each of the 5 RODs will be conducted in September 2004.

11.0 Implementation Requirements

The implementation requirements interpreted here are considered to be additional actions to those already specified in the individual RODs. If a remedy is determined to be protective or data suggests that cleanup standards will be achieved, no implemented requirements are specified. As always, WPAFB as the lead agency will be responsible for implementing the actions with support from Ohio EPA and USEPA.

11.1 21 No Action Sites ROD

No implementation measures are proposed at this time for the 21 No Action sites.

11.2 41 No Action Sites ROD

No implementation measures are proposed at this time for the 41 No Action sites.

11.3 Source Control Operable Unit ROD

No implementation measures are proposed at this time; continuation of long-term groundwater monitoring is recommended.

11.4 Off-Source Operable Unit ROD

Implementation measures are proposed for groundwater downgradient from LF8 and LF10. This groundwater should be continued to be monitored as part of the Basewide LTM program. Any necessary remedial actions to groundwater should be determined through this program as a result of future monitoring efforts.

11.5 Spill Sites 2, 3, and 10 (OU2) ROD

Implementation measures are proposed for soil. Soil confirmation sampling for BETX is recommended to verify if soil remediation goals have been met and that soil gas monitoring can cease.

No implementation measures are proposed at this time for groundwater; continuation of long-term groundwater monitoring is recommended.

12.0 References

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Table 2-1

Operable Units Addressed in WPAFB Record of Decisions

Record of Decision	Number of IRP Sites Addressed	Operable Units Addressed
21 No Action Sites	21	OU2; OU3; OU5; OU6; OU10
41 No Action Sites	41	OU3; OU4; OU5; OU6; OU7; OU8; OU9; OU10; OU11
Source Control Operable Unit	2	OU1
Off-Source Operable Unit	2	OU1
Spill Sites 2, 3, and 10	3	OU2

Table 3-1

**Sites Included in Five-Year Review of the
Record of Decision for 21 No Action Sites
Wright-Patterson AFB, Ohio**

Site Name	Site Abbreviation	Operable Unit
Burial Site 1	BS1	OU2
Long-Term Coal Storage Area	LTCSA	OU2
Temporary Coal Storage Pile	TCSP	OU2
Coal and Chemical Storage Area	CCSA	OU2
Building 89 Coal Storage Pile	B89CSP	OU2
Landfill 14	LF14	OU3
Fire Training Area 2	FTA2	OU3
Fire Training Area 3	FTA3	OU3
Fire Training Area 4	FTA4	OU3
Fire Training Area 5	FTA5	OU3
Spill Site 1	SS1	OU3
Earthfill Disposal Zone 11	EFDZ11	OU3
Earthfill Disposal Zone 12	EFDZ12	OU3
Fire Training Area 1	FTA1	OU5
Gravel Lake Tank Site	GLTS	OU5
Burial Site 4	BS4	OU5
Earthfill Disposal Zone 1	EFDZ1	OU6
Central Heating Plant 3	HP3	OU10
Landfill 13	LF13	OU10
Tank Farm 49A	TF49A	OU10
Underground Storage Tanks at Building 30119	UST30119	OU10

Table 4-1

**Sites Included in Five-Year Review of the
Record of Decision for 41 No Action Sites
Wright Patterson AFB, Ohio
Page 1 of 2**

Site Name	Site Abbreviation	Operable Unit
Landfill 11	LF11	OU3
Landfill 12	LF12	OU3
Landfill 3	LF3	OU4
Landfill 4	LF4	OU4
Landfill 6	LF6	OU4
Landfill 7	LF7	OU4
Landfill 5	LF5	OU5
Landfill 1	LF1	OU6
Landfill 2	LF2	OU6
Landfill 9	LF9	OU7
Spill Site 5	SP5	OU8
Spill Site 6	SP6	OU8
Spill Site 7	SP7	OU8
Spill Site 9	SP9	OU8
Spill Site 11	SP11	OU8
Underground Storage Tank 71A	UST71A	OU8
Burial Site 3	BS3	OU9
Central Heating Plant 5	HP5	OU9
Deactivated Nuclear Reactor	NUC	OU9
Earthfill Disposal Zone 2	EFDZ2	OU9
Earthfill Disposal Zone 3	EFDZ3	OU9
Earthfill Disposal Zone 4	EFDZ4	OU9
Earthfill Disposal Zone 5	EFDZ5	OU9
Earthfill Disposal Zone 6	EFDZ6	OU9
Earthfill Disposal Zone 7	EFDZ7	OU9
Earthfill Disposal Zone 8	EFDZ8	OU9
Earthfill Disposal Zone 9	EFDZ9	OU9
Earthfill Disposal Zone 10	EFDZ10	OU9
East Ramp Tank Removal	East Ramp UST	OU10
Spill Site 4	SP4	OU10
Burial Site 2	BS2	OU11
Chemical Disposal Area	CDA	OU11
Underground Storage Tank at Building 4020	UST4020	OU11
Burial Site 5	BS5	NA
Burial Site 6	BS6	NA
Central Heating Plant 1	HP1	NA
Central Heating Plant 2	HP2	NA
Central Heating Plant 4	HP4	NA
Explosive Ordnance Disposal Range	EOD Range	NA

Table 4-1

**Sites Included in Five-Year Review of the
Record of Decision for 41 No Action Sites
Wright Patterson AFB, Ohio
Page 2 of 2**

Site Name	Site Abbreviation	Operable Unit
Radioactive Waste Burial Site	RADB	NA
Spill Site 8	SP8	NA

NA – Not Applicable.

Table 4-2

**Land Use for 41 No Action Sites
Wright-Patterson AFB, Ohio
Page 1 of 2**

Site Name	Site Tracking Name	Land Use Classification¹	Current Land Use
Landfill 1	LF1	O	Undeveloped
Landfill 2	LF2	O	Wooded, undeveloped
Landfill 3	LF3	C	Golf course
Landfill 4	LF4	I	Equipment storage
Landfill 6	LF6	O	Pasture
Landfill 7	LF7	O	Equestrian facility
Landfill 5	LF5	I/O	Recreational
Landfill 9	LF9	O	Undeveloped
Landfill 11	LF11	O	Recreational
Landfill 12	LF12	O	Recreational
Spill Site 5	SP5	I	Research laboratories
Spill Site 6	SP6	C	Building, grass
Spill Site 7	SP7	I	Fuel storage
Spill Site 9	SP9	I	Fuel storage
Spill Site 11	SP11	I	Aircraft Survivability Research Facility
UST71A	UST71A	I	Research laboratories
Earthfill Disposal Zone 2	EFDZ2	I	Undeveloped
Earthfill Disposal Zone 3	EFDZ3	I	Undeveloped
Earthfill Disposal Zone 4	EFDZ4	O/I	Paved streets, grass
Earthfill Disposal Zone 5	EFDZ5	O	Grass
Earthfill Disposal Zone 6	EFDZ6	I	Developed/building site
Earthfill Disposal Zone 7	EFDZ7	O	Paved streets, grass
Earthfill Disposal Zone 8	EFDZ8	O/I	Undeveloped
Earthfill Disposal Zone 9	EFDZ9	O	Undeveloped

Table 4-2

**Land Use for 41 No Action Sites
Wright-Patterson AFB, Ohio
Page 2 of 2**

Site Name	Site Tracking Name	Land Use Classification¹	Current Land Use
Earthfill Disposal Zone 10	EFDZ10	O	Wooded, undeveloped
Burial Site 3	BS3	O	Undeveloped
Burial Site 5	BS5	O	Undeveloped
Burial Site 6	BS6	O	Undeveloped
Deactivated Nuclear Reactor	NUC	I	Decommissioned, laboratories, classroom
Spill Site 4	SP4	I	Building/paved streets
East Ramp UST	ERTR	I	Paved/grass
Burial Site 2	BS2	O	Paved/grass
Building 4020 UST	UST4020	I	Paved/grass
Chemical Disposal Area	CDA	I/O	Paved/grass
Central Heating Plant 1	HP1	I	Closed heating plant
Central Heating Plant 2	HP2	I	Closed heating plant
Central Heating Plant 4	HP4	I	Operational heating plant
Central Heating Plant 5	HP5	I	Operational heating plant
Spill Site 8	SP8	I	
Radioactive Waste Burial Site	RADB	O	Undeveloped
Explosive Ordnance Disposal Range	EOD	I	Industrial

¹ Based on 1997 Management Action Plan.

I = Industrial, including aircraft maintenance
C = Commercial, including administrative and office
O = Open, including recreational

Table 5-1
Comparison of Compliance Levels with Detected COCs in Groundwater
Source Control Operable Unit - Landfills 8 and 10
Wright-Patterson Air Force Base, Ohio
Page 1 of 2

Chemicals of Concern ^a	Current Compliance Level ^b (Fg/L)	Maximum Detected Concentration ^c (Fg/L)			
		LF8 Monitoring Wells	LF8 Extraction Wells	LF10 Monitoring Wells	LF10 Extraction Wells
<u>Inorganics</u>					
Arsenic	11.0	770	1100 ^e	273	163
Beryllium	0.02	7	ND	10	ND
Cadmium	NA ^d	3	0.9	3.3	0.7
Copper	NA	5400	40	631	0.03
Iron	NA	370,000	802,000	407,000	73,800
Lead	NA	400	26	233	83
Zinc	NA	590	3010	1,460	67
Cyanide	NA	ND	16	ND	ND
Ammonia	NA	2500	34,000	2,300	900
<u>Volatile Organics</u>					
Benzene	0.62	8	27	3.2	13
Chloroform	0.28	ND	3	ND	21
Trans 1,2-DCE	6.77x10 ⁻²	0.22	2.7	ND	3
Ethylbenzene	NA	0.39	33	ND	45
Methylene Chloride	6.22	29	950	27	45
Toluene	NA	20	150	55	14
Trichloroethene	3.03	ND	2	1.2	ND
Vinyl chloride	2.83x10 ⁻²	10	49	4.2	2

Table 5-1

**Comparison of Compliance Levels with Detected Constituent Concentrations in
Groundwater
Source Control Operable Unit - Landfills 8 and 10
Wright-Patterson Air Force Base, Ohio
Page 2 of 2**

Chemicals of Concern ^a	Current Compliance Level ^b (Fg/L)	Maximum Detected Concentration ^c (Fg/L)			
		LF8 Monitoring Wells	LF8 Extraction Wells	LF10 Monitoring Wells	LF10 Extraction Wells
<u>Semivolatile Organics</u>					
Diethylphthalate	NA	ND	ND	ND	200
4-Methylphenol	NA	ND	320	ND	ND
Naphthalene	NA	0.5	16	0.81	15
<u>Dioxins</u>					
1,2,3,4,6,7,8-HpCDD	5.67x10 ⁻⁵	5.2x10 ⁻⁵	8.0x10 ⁻⁶	1.0x10 ⁻⁵	ND
1,2,3,4,6,7,8-HpCDF	5.67x10 ⁻⁵	7.3x10 ⁻⁶	2.5x10 ⁻⁶	ND	ND
1,2,3,4,6,7,8-HxCDD	5.67x10 ⁻⁶	1.4x10 ⁻⁶	ND	5.3x10 ⁻⁶	ND
2,3,7,8-TCDD	5.67x10 ⁻⁷	ND	ND	3.8x10 ⁻⁶	ND
2,3,7,8-TCDF	5.67x10 ⁻⁶	5.7x10 ⁻⁶	ND	ND	ND
1,2,3,4,6,7,8,9-OCDD	5.67x10 ⁻⁴	1.0x10 ⁻³	1.2x10 ⁻⁴	2.2x10 ⁻⁴	2.7x10 ⁻⁶
1,2,3,4,6,7,8,9-OCDF	5.67x10 ⁻⁴	4.4x10 ⁻⁵	1.2x10 ⁻⁵	1.0x10 ⁻⁵	ND

- a Chemicals listed as chemicals of concern in the Source Control Operable Unit ROD.
b Groundwater compliance levels listed in Table 8 of the Source Control Operable Unit ROD.
c Maximum detected groundwater concentration from 1996 to October 1998.
d NA = not applicable.
e Box denotes exceedence of current compliance level.
COC Chemical of concern
DCE Dichloroethene

Table 5-2

**Landfill 8 Explosive Gas Monitoring
Field Measurements: April 1999
Wright-Patterson AFB, Ohio**

Location	Probe Press. (2) (in. of H ₂ O)	Probe Oxygen (%)	(% Methane/% LEL)		Methane TLV (5)	Utility Line(s) Monitored	Distance/Direction From Nearest Probe/Structure	Comments
			Initial (3)	Sustained (4)				
Landfill 8								
LF08-MP001	2.08	6.7	0.2/008	--	0.11	Unknown	91 ft. West	
LF08-MP002	2.10	16.9	0/0	--	0.19	Unknown	150 ft. West	
LF08-MP003	2.13	20.5	0/0	--	0.25	Unknown	200 ft. West	
LF08-MP004	2.13	20.7	0/0	--	0.23	Unknown	160 ft. West	
LF08-MP006	2.14	20.8	0/0	--	0.05	Unknown	39 ft. South	
LF08-MP007	2.13	20.7	0/0	--	0.06	Unknown	50 ft. North	
LF08-MP008	2.08	4.4	0/0	--	0.02	Unknown	17 ft. North	
LF08-MP009	2.10	20.7	0/0	--	0.03	Unknown	20 ft. North	
LF08-MP010	2.09	3.2	18.3/352	0.7/14	0.03	Unknown	22 ft. North	
LF08-MP011	2.09	13.5	0/0	--	0.02	Unknown	17 ft. North	
LF08-MP012	2.12	1.2	0/0	--	0.02	Unknown	13 ft. North	
LF08-MP013	NA	15.6	0/0	--	0.03	Unknown	20 ft. South	Pressure valve broken
LF08-PT003	NA	21.0	0/0	--	0.02	Unknown	12 ft. North	

Notes:

1. Abbreviations: in. = inches; ft,bgs = feet below ground surface; TLV = threshold limit value (see Note 5); N/A = not available; GBT = gas barrier trench, N = north, S = south.
2. Pressure readings taken via pressure valve in unvented cap at top of probe.
3. Initial gas concentrations reading taken after purging probe a minimum of 30 seconds.
4. Sustained combustible gas concentration reading taken approximately one half hour after removing unvented lid from monitoring probe.
5. Methane TLV was calculated using the formula $T = (0.00125)(H)$, where T = threshold limit value, H = horizontal distance in feet between probe and closest occupied structure.

Table 5-3

**Landfill 10 Explosive Gas Monitoring
Field Measurements:
April 1999
Wright-Patterson AFB, Ohio**

Location	Probe Press. (2) (in. of H ₂ O)	Probe Oxygen (%)	(% Methane/% LEL)		Methane TLV (5)	Utility Line(s) Monitored	Distance/Direction From Nearest Probe/Structure	Comments
			Initial (3)	Sustained (4)				
Landfill 10								
LF10-MP014	2.12	20.6	0/0	--	0.04	Unknown	30 ft. Northwest	Could not reach
LF10-MP016	2.16	20.6	0/0	--	0.11	Unknown	87 ft. Southeast	
LF10-MP018	NA	NA	NA	--	0.08	Unknown	61 ft. North	
LF10-MP019	2.13	20.6	0/0	--	0.03	Unknown	25 ft. West	
LF10-MP020	2.15	20.7	0/0	--	0.02	Unknown	18 ft. East	
LF10-MP021	2.13	20.6	0/0	--	0.02	Unknown	17 ft. East	
LF10-MP023	2.17	20.7	0/0	--	0.02	Unknown	15 ft. Southeast	
LF10-MP026	2.15	20.8	0/0	--	0.02	Unknown	18 ft. East	
LF10-PT030	NA	20.4	0/0	--	0.09	Cable TV	70 ft. East	
LF10-PT031	NA	20.7	0/0	--	0.09	Cable TV	70 ft. East	
LF10-PT035	NA	21.0	0/0	--	0.08	Cable TV	66 ft. East	
LF10-PT036	NA	20.9	0/0	--	0.09	Cable TV	69 ft. East	
LF10-PT060	NA	20.7	0/0	--	0.08	Unknown	65 ft. East	
LF10-PT065	NA	20.8	0/0	--	0.09	Unknown	69 ft. East	
LF10-PT078	NA	20.7	0/0	--	0.05	Sewer	39 ft. Northeast	
LF10-PT085	NA	20.5	0/0	--	0.08	Sewer/Electric	60 ft. Southwest	
LF10-PT088	NA	21.0	0/0	--	0.02	Gas	14 ft. Northeast	
LF10-PT090	NA	20.8	0/0	--	0.24	Gas	196 ft. Southeast	
LF10-PT091	NA	20.7	0/0	--	0.28	Sewer	225 ft. Southeast	
LF10-PT093	NA	20.6	0/0	--	0.38	Sewer	225 ft. Southeast	
LF10-PT095	NA	20.8	0/0	--	0.38	Sewer	300 ft. North	
LF10-PT100	NA	20.7	0/0	--	0.44	Sewer	350 ft. Southeast	
LF10-GBT0S	2.09	0.4	57.7/>>>>(6)	46.4/932	0.09	GBT-S	75 ft. Southeast	
LF10-GBT0N	NA	NA	NA	0/0	--	GBT-N	39 ft. East	Water

Notes:

- Abbreviations: in. = inches; ft,bgs = feet below ground surface; TLV = threshold limit value (see Note 5); NA = not available; NT = not take; GBT = gas barrier trench, N = north, S = south.
- Pressure readings taken via pressure valve in unvented cap at top of probe.
- Initial gas concentrations reading taken after purging probe a minimum of 30 seconds.
- Sustained combustible gas concentration reading taken approximately one half hour after removing unvented lid from monitoring probe.
- Methane TLV was calculated using the formula $T = (0.00125)(H)$, where T = threshold limit value, H = horizontal distance in feet between probe and closest occupied structure.
- >>> LEL % level went off the scale of the meter.

Table 5-4

**Comparison of Compliance Levels with Regulatory Levels and Detection Limits
for Groundwater
Source Control Operable Unit - Landfills 8 and 10
Wright-Patterson Air Force Base, Ohio
Page 1 of 2**

Chemicals of Concern^a	Compliance Level^b (Fg/L)	MCL^c (Fg/L)	Risk-based PRG^d (Fg/L)	Detection Limit^e (Fg/L)
<i>Inorganics</i>				
Arsenic	11.0	50	4.5x10 ⁻² c	10
Beryllium	0.02	4	73 n	5
Cadmium	NA ^f	5	18 n	5
Copper	NA	1300 ^c	1400 n	25
Iron	NA	NA	11,000 n	100
Lead	NA	15 ^c	4 n	3
Zinc	NA	NA	11,000 n	20
Cyanide	NA	200	730 n	10
Ammonia	NA	NA	NA	100
<i>Volatile Organics</i>				
Benzene	0.62	5	0.39 c	1
Chloroform	0.28	80 ^c	0.16 c	1
1,2-Dichloroethene(t)	6.77x10 ⁻²	100	120 n	1
Ethyl benzene	NA	700	1300 n	1
Methylene Chloride	6.22	NA	4.3 c	1
Toluene	NA	1000	720 n	1
Trichloroethene	3.03	5	1.6 c	1
Vinyl chloride	2.83x10 ⁻²	2	2x10 ⁻²	1
<i>Semivolatile Organics</i>				
Diethylphthalate	NA	6	29,000 n	10

Table 5-4

**Comparison of Compliance Levels with Regulatory Levels and Detecton Limits
for Groundwater
Source Control Operable Unit - Landfills 8 and 10
Wright-Patterson Air Force Base, Ohio
Page 2 of 2**

Chemicals of Concern^a	Compliance Level^b (Fg/L)	MCL^c (Fg/L)	Risk-based PRG^d (Fg/L)	Detection Limit^e (Fg/L)
4-Methylphenol	NA	NA	180 n	10
Naphthalene	NA	NA	6.2 n	10
<i>Dioxins</i>				
1,2,3,4,6,7,8-HpCDD	5.67x10 ⁻⁵	NA	-- ^g	5x10 ⁻⁵
1,2,3,4,6,7,8-HpCDF	5.67x10 ⁻⁵	NA	--	5x10 ⁻⁵
1,2,3,4,6,7,8-HxCDD	5.67x10 ⁻⁶	NA	--	5x10 ⁻⁵
2,3,7,8-TCDD	5.67x10 ⁻⁷	3x10 ⁻⁵	4.5x10 ⁻⁷ c	1x10 ⁻⁵
2,3,7,8-TCDF	5.67x10 ⁻⁶	NA	4.5x10 ⁻⁶ c	1x10 ⁻⁵
1,2,3,4,6,7,8,9-OCDD	5.67x10 ⁻⁴	NA	4.5x10 ⁻⁴ c	1x10 ⁻⁴
1,2,3,4,6,7,8,9-OCDF	5.67x10 ⁻⁴	NA	4.5x10 ⁻⁴ c	1x10 ⁻⁴

- a Chemicals listed as chemicals of concern in the Source Control Operable Unit ROD.
b Groundwater compliance levels listed in Table 8 of the Source Control Operable Unit ROD.
c Maximum Contaminant Levels.
d U.S. Environmental Protection Agency Region 9 Preliminary Remediation Goals (USEPA, 1998). "c" = PRG based on target cancer risk of 1x10⁻⁶; "n" = PRG based on target hazard index of 1 for noncarcinogens;
e Detection limit for *****
f NA = not available.
g Dioxin congener PRGs based on toxicity equivalency to 2,3,7,8-TCDD; "--" = not considered a toxic congener of TCDD.

Table 7-1
Mann-Kendall Test for Trend on Monitoring Well Data from OU2
Wright-Patterson Air Force Base, Dayton, Ohio

Well ID	Benzene				BTEX			
	Concentration Trend	S	α	Significance Level of Observed Trend	Concentration Trend	S	α	Significance Level of Observed Trend
04-016-M	Decreasing	-15	0.015	99%	Decreasing	-5	0.281	72%
04-518-M	Decreasing	-1	0.5	50%	Decreasing	-3	0.386	61%
OW-1	Decreasing	-6	0.0117	99%	Decreasing	-4	0.242	76%
OW-2	Clean Well	NA	NA	NA	Clean Well	NA	NA	NA
OW-3	Increasing	4	0.242	76%	Increasing	4	0.242	76%
OW-4	Clean Well	NA	NA	NA	Clean Well	NA	NA	NA
P11-1	Clean Well	NA	NA	NA	Clean Well	NA	NA	NA
P18-1	Decreasing	-5	0.189	81%	Decreasing	-2	0.408	59%
P18-2	Decreasing	-10	0.0083	99%	Decreasing	-10	0.0083	99%
NEA-MW20-2S	Decreasing	-10	0.138	86%	Decreasing	-22	0.0028	100%
NEA-MW28-5S	Decreasing	-14	0.054	95%	Decreasing	-14	0.054	95%

NOTES:

Concentration Trend, the sign of the "S" value from the Mann-Kendall test.

A negative sign indicates a decreasing concentration trend.

S, the Mann-Kendall Trend Statistic from Table A18, J. O. Gilbert, 1987, Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, NY.

α , probability that there is no trend in the data.

Significance Level of the Observed Trend, the probability expressed in percent that a trend exists in the data.

Table 7-2
OU2 Benzene Concentration Comparison
Wright-Patterson Air Force Base, Ohio

Well Number	Sample Date	Benzene Maximum Conc. (Fg/L)	Benzene Conc. April 1999 (Fg/L)
04-016-M	8/21/91	440	2.6
04-518-M	9/6/88	2,600	250
NEA-MW20-2S	12/17/92	75	37
NEA-MW21-3S	5/22/97	Free Product	240
NEA-MW28-5S	12/8/92	120	ND ^a
P18-1	3/25/91	570	4.6
P18-2	8/21/91	1,900	ND

a ND - not detected

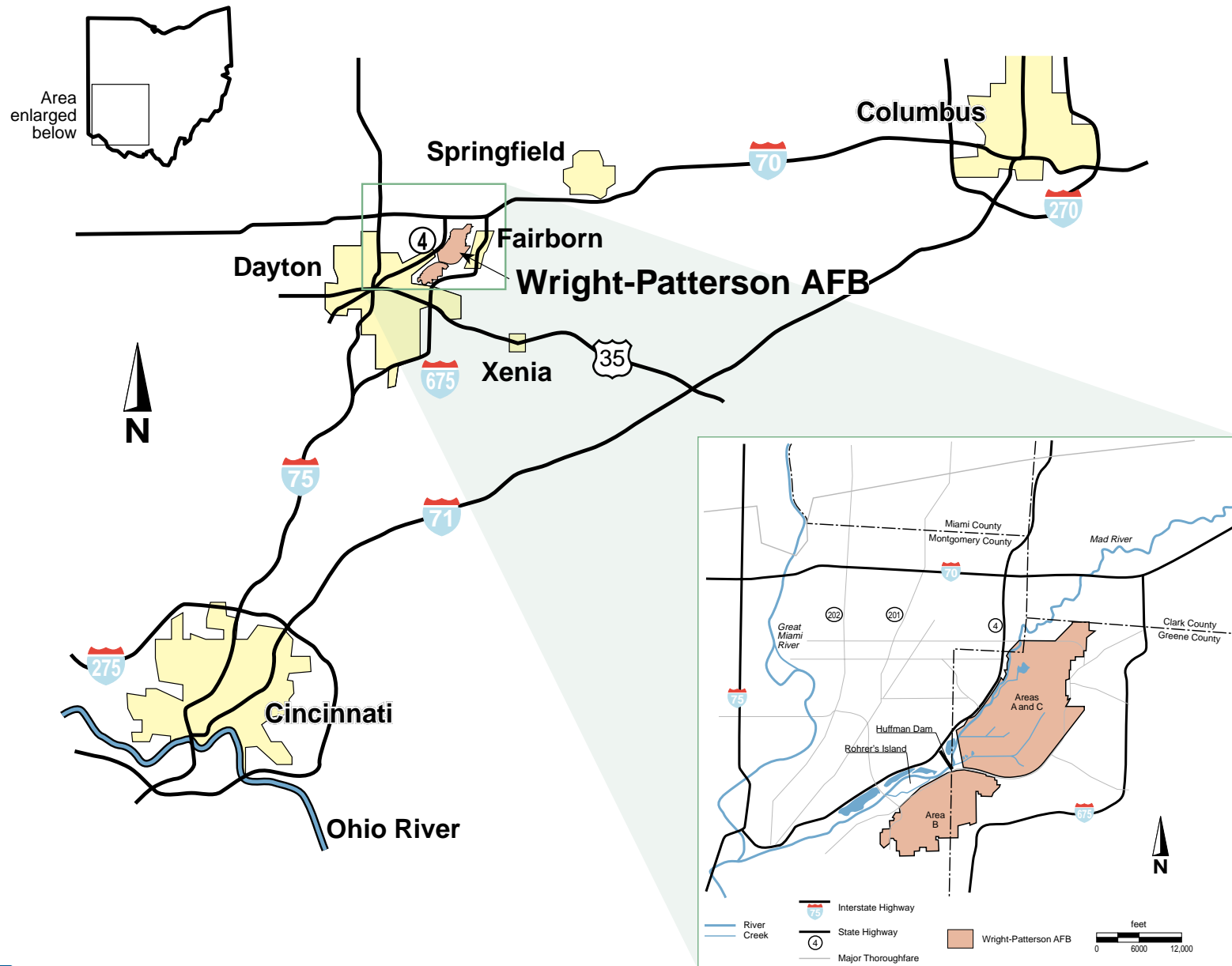


Figure 2-1. Area Location Map.



DRAWING BY	JIS, III	CHECKED BY	JIS, III	4/21/95	DRAWING NO. S-762297.0602-7/99-1w
	9/11/97		JRT	7/23/99	

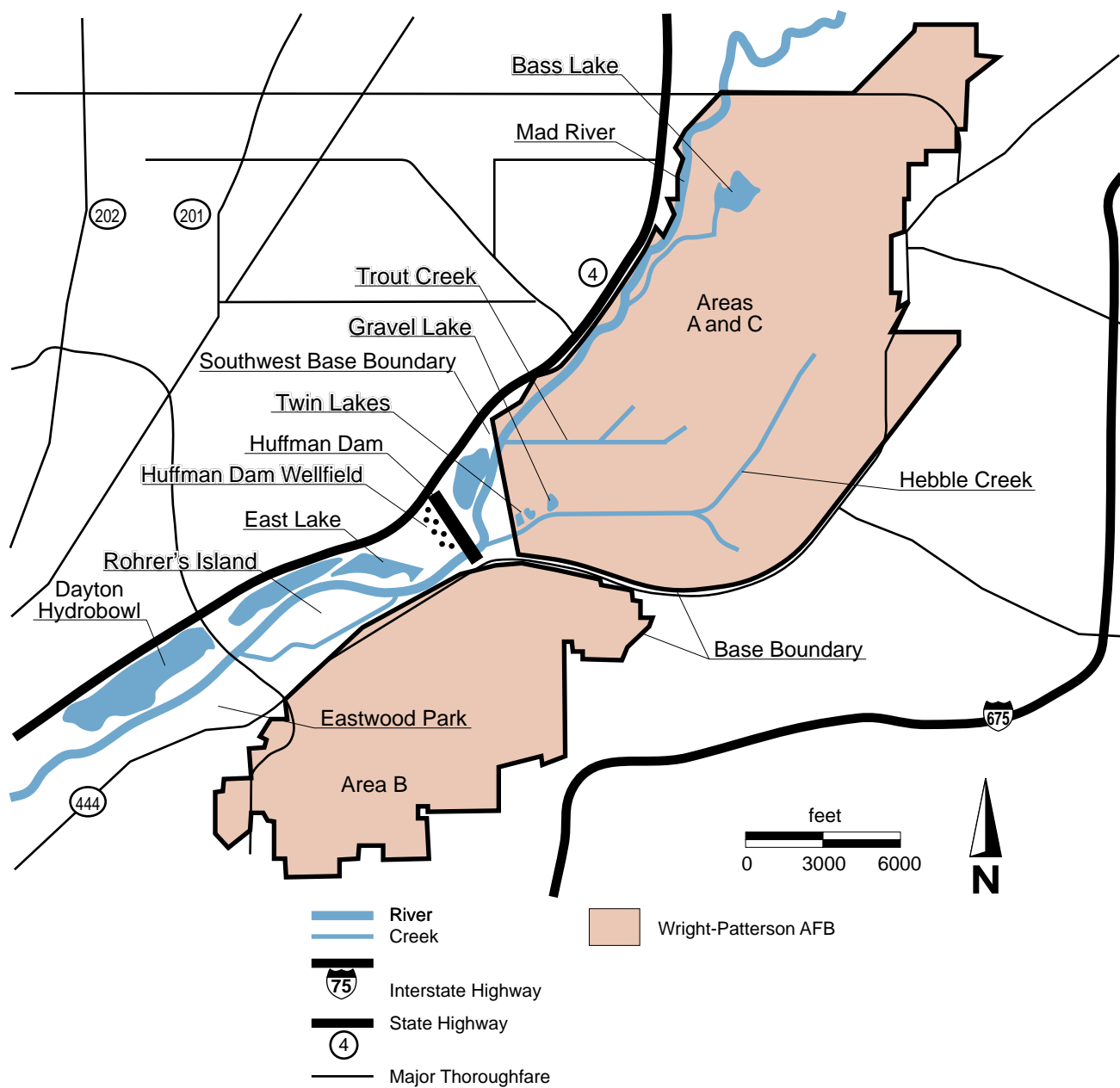


Figure 2-2. WPAFB Administrative Areas.

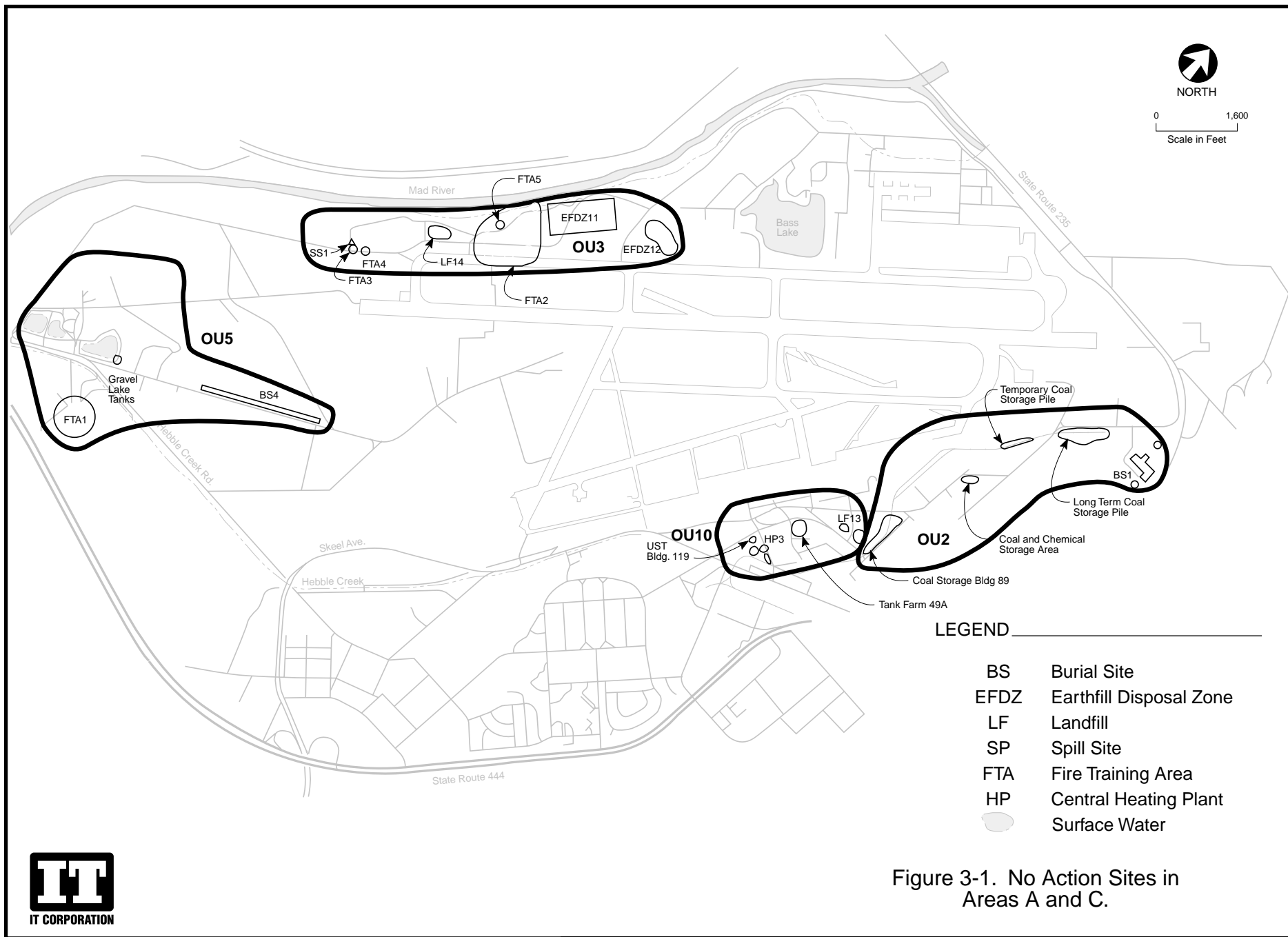


Figure 3-1. No Action Sites in Areas A and C.



DRAWING BY	JIS, III	CHECKED BY	TC	DRAWING NO.
	7/2/99	APPROVED BY	7/7/99	S-777097.05-7/99-9w

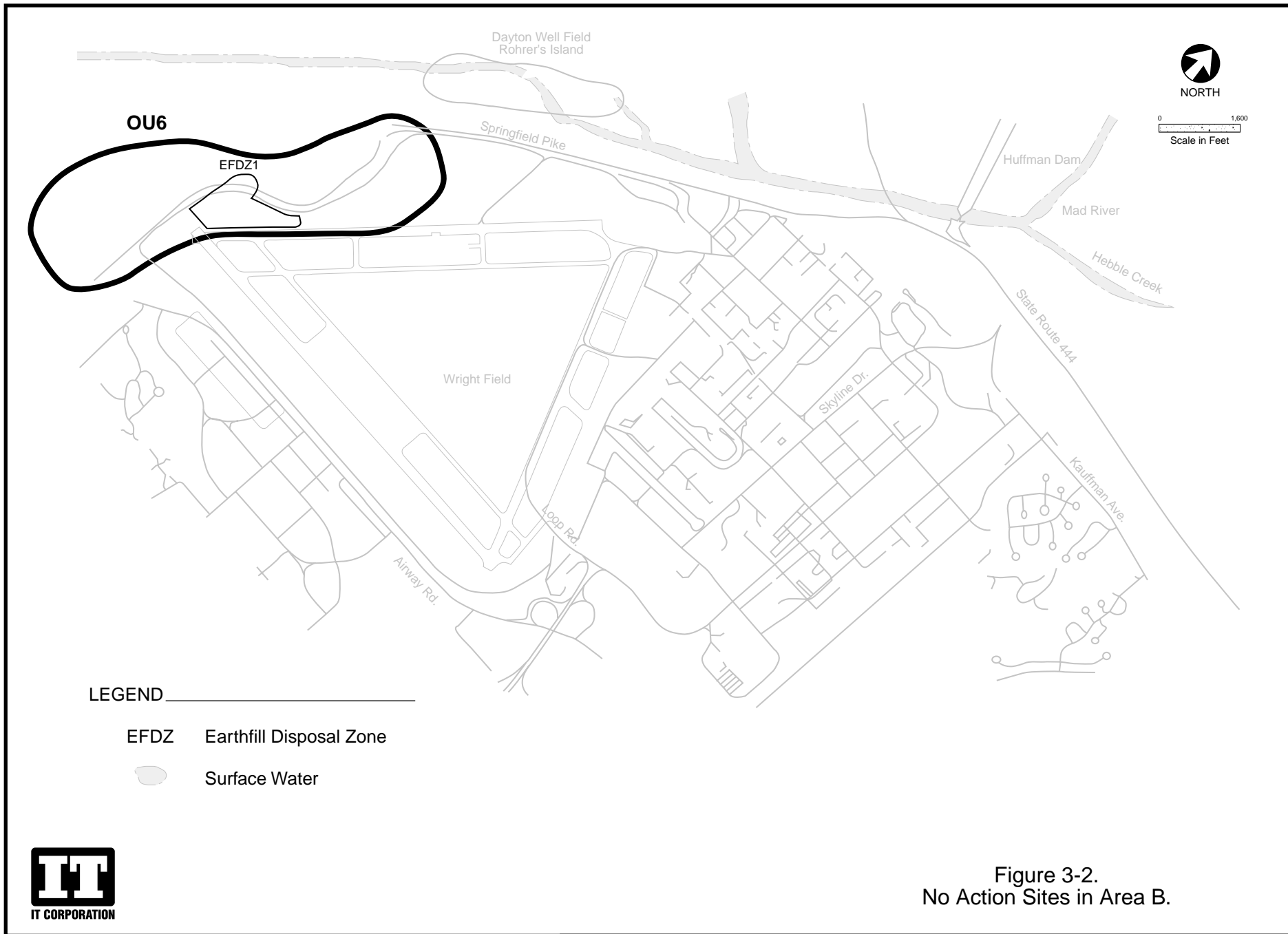
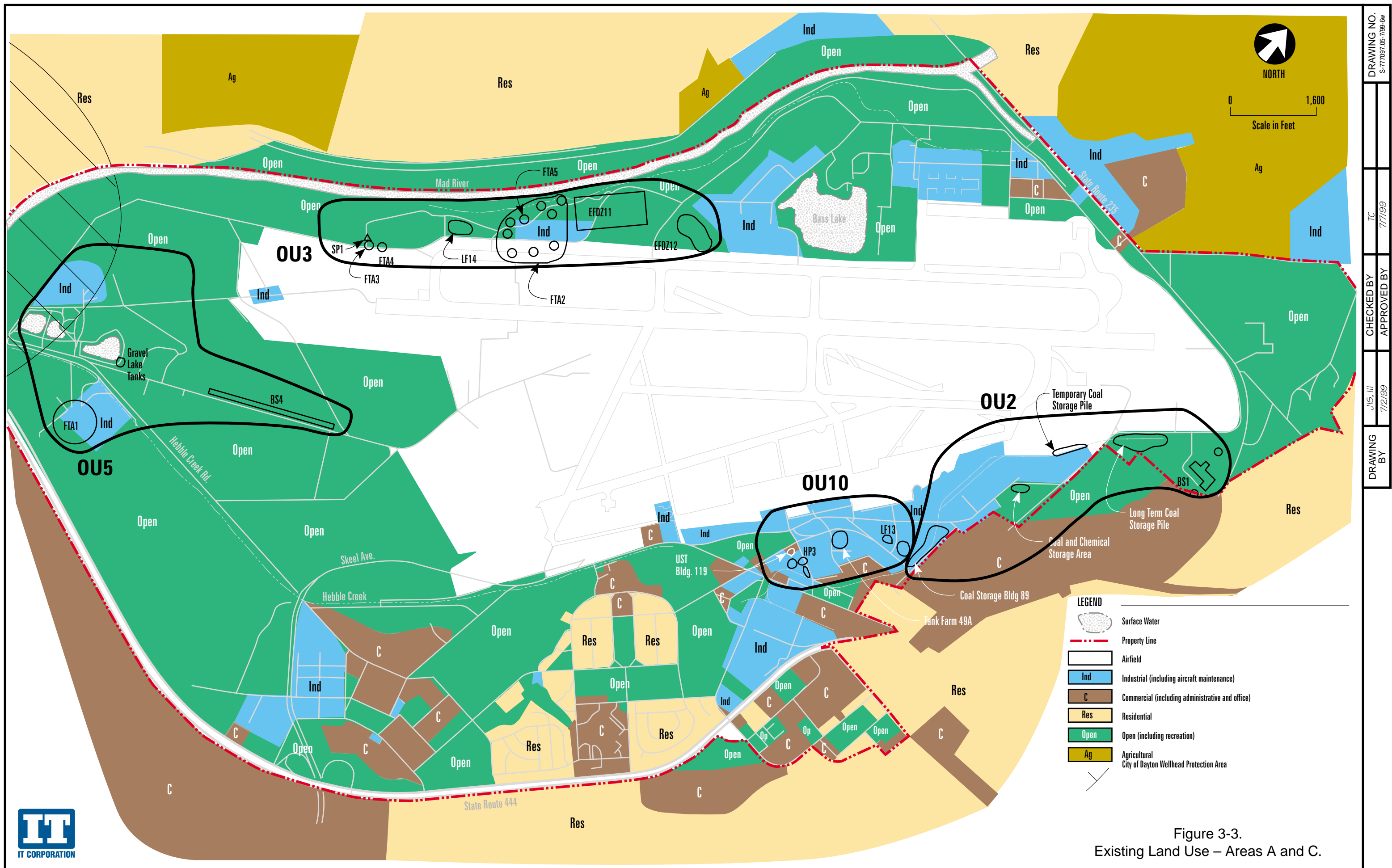
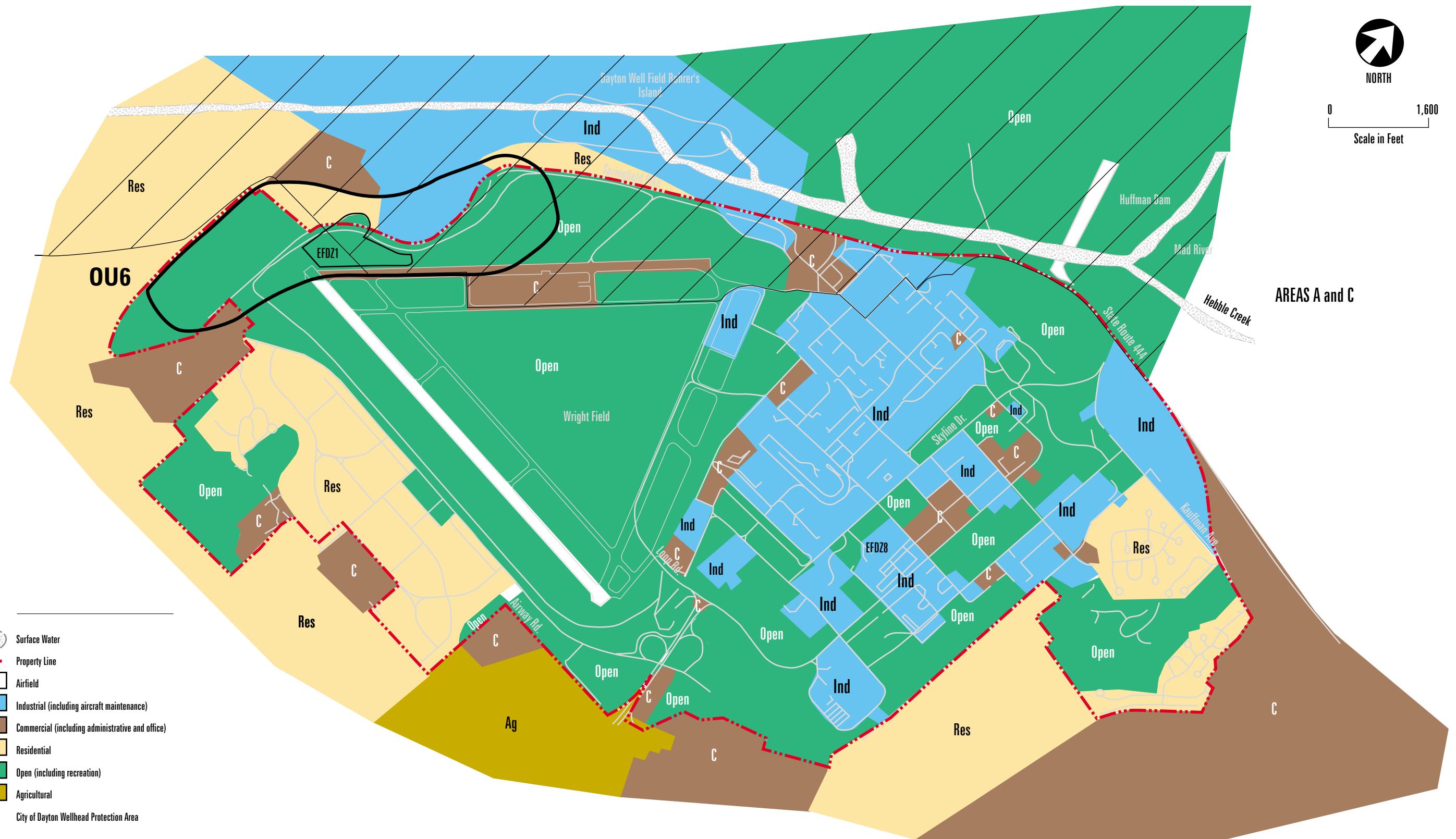


Figure 3-2.
No Action Sites in Area B.

DRAWING BY	JIS, III	CHECKED BY	TC		DRAWING NO. S-777097.05-7/99-7W
	7/2/99		7/7/99		
		APPROVED BY			





0 1,600
Scale in Feet

AREAS A and C



Figure 3-4.
Existing Land Use – Area B.

DRAWING NO.	S-77097.05-799-Bw
CHECKED BY	JLS, III
APPROVED BY	7/2/99
TC	7/7/99

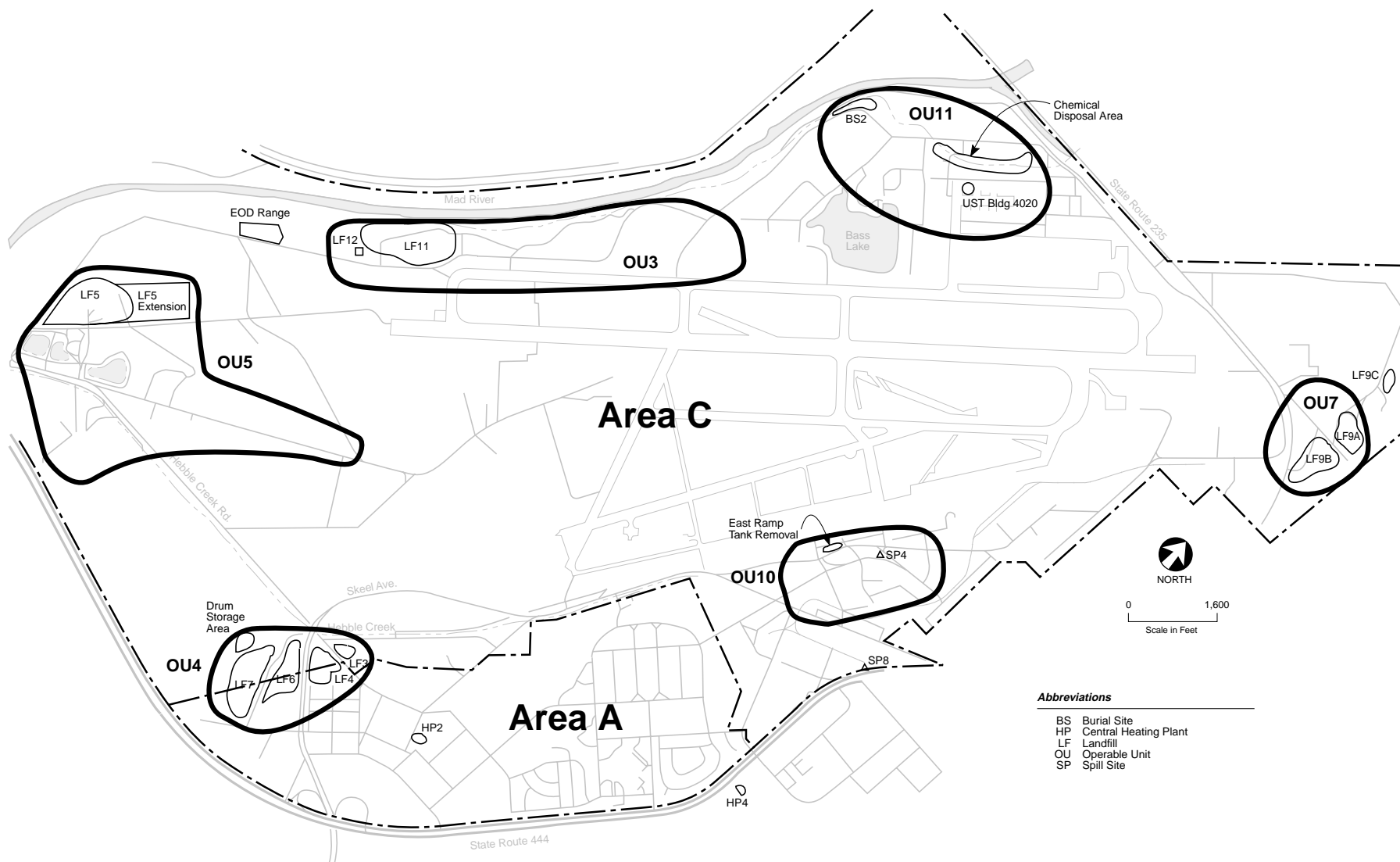


Figure 4-1. No Action Sites in Areas A and C.



DRAWING BY	JIS, III 7/2/99	CHECKED BY	TC 7/7/99	DRAWING NO.
		APPROVED BY		S-777097.05-7/99-5w

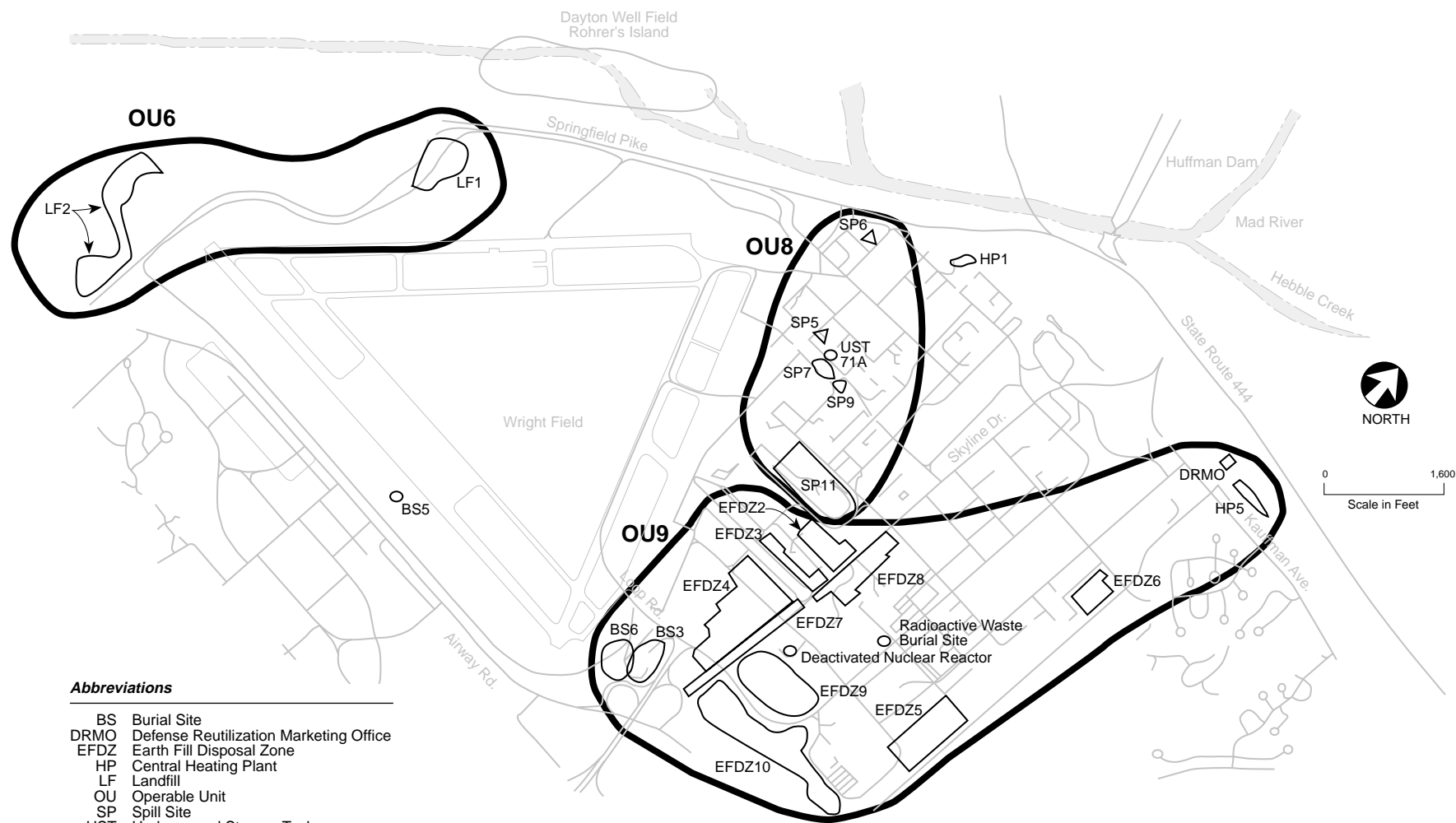
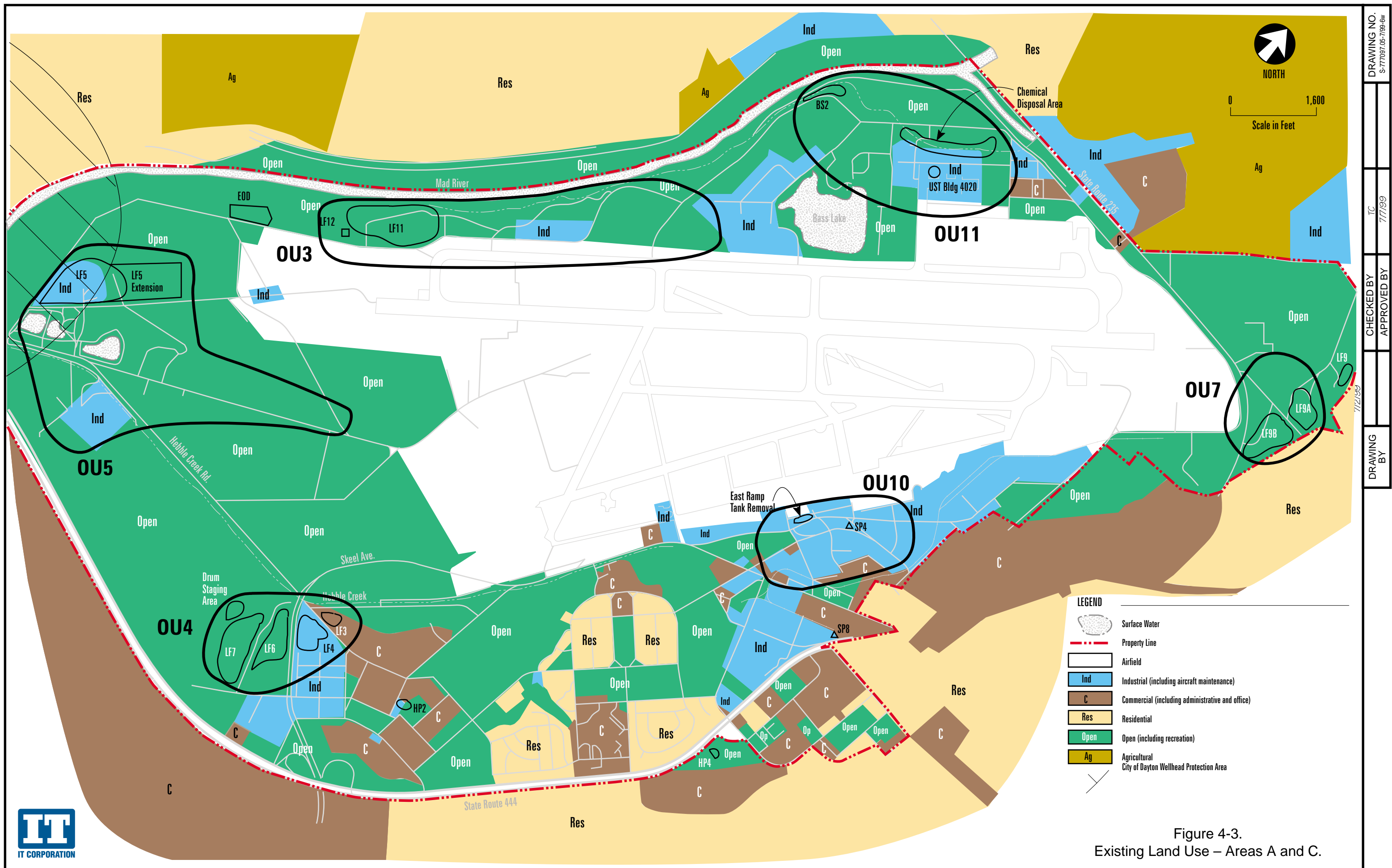
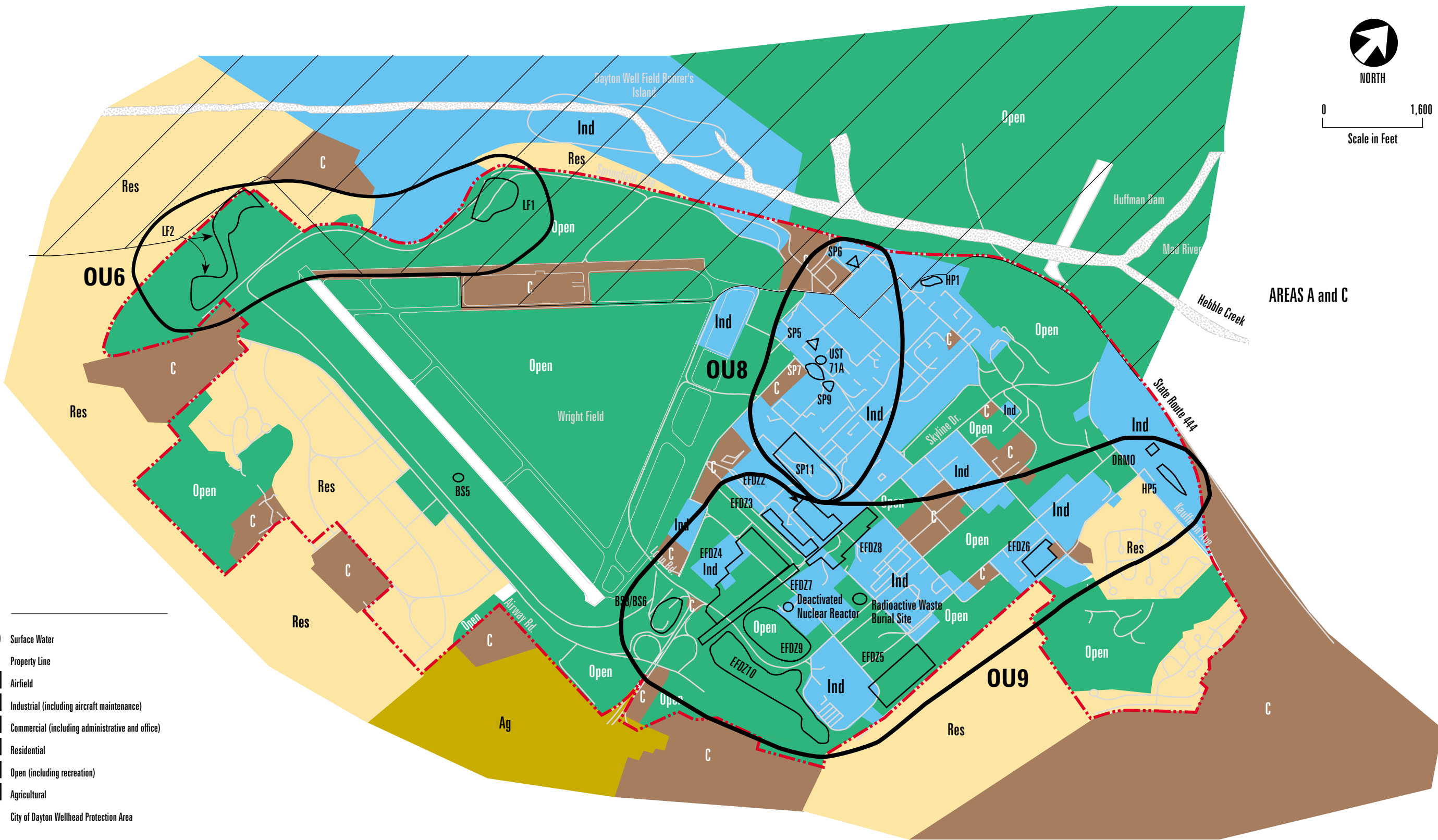


Figure 4-2. No Action Sites in Area B.



DRAWING BY	JIS, III	CHECKED BY	TC	DRAWING NO.
	7/2/99		7/7/99	
		APPROVED BY		S-777097.05-7/99-9w





AREAS A and C



0 1,600
Scale in Feet

- LEGEND**
- Surface Water
 - Property Line
 - Airfield
 - Ind Industrial (including aircraft maintenance)
 - C Commercial (including administrative and office)
 - Res Residential
 - Open Open (including recreation)
 - Ag Agricultural
 - City of Dayton Wellhead Protection Area



Figure 4-4.
Existing Land Use – Area B.

DRAWING NO.	S-777097.05-7/99-10w
CHECKED BY	JLS, III
APPROVED BY	7/7/99
DRAWING BY	7/2/99

DRAWING NO.	S-777097.05-799-2W		
DRAWING BY	JIS, III	TC	7/7/99
	7/2/99		
CHECKED BY			
APPROVED BY			

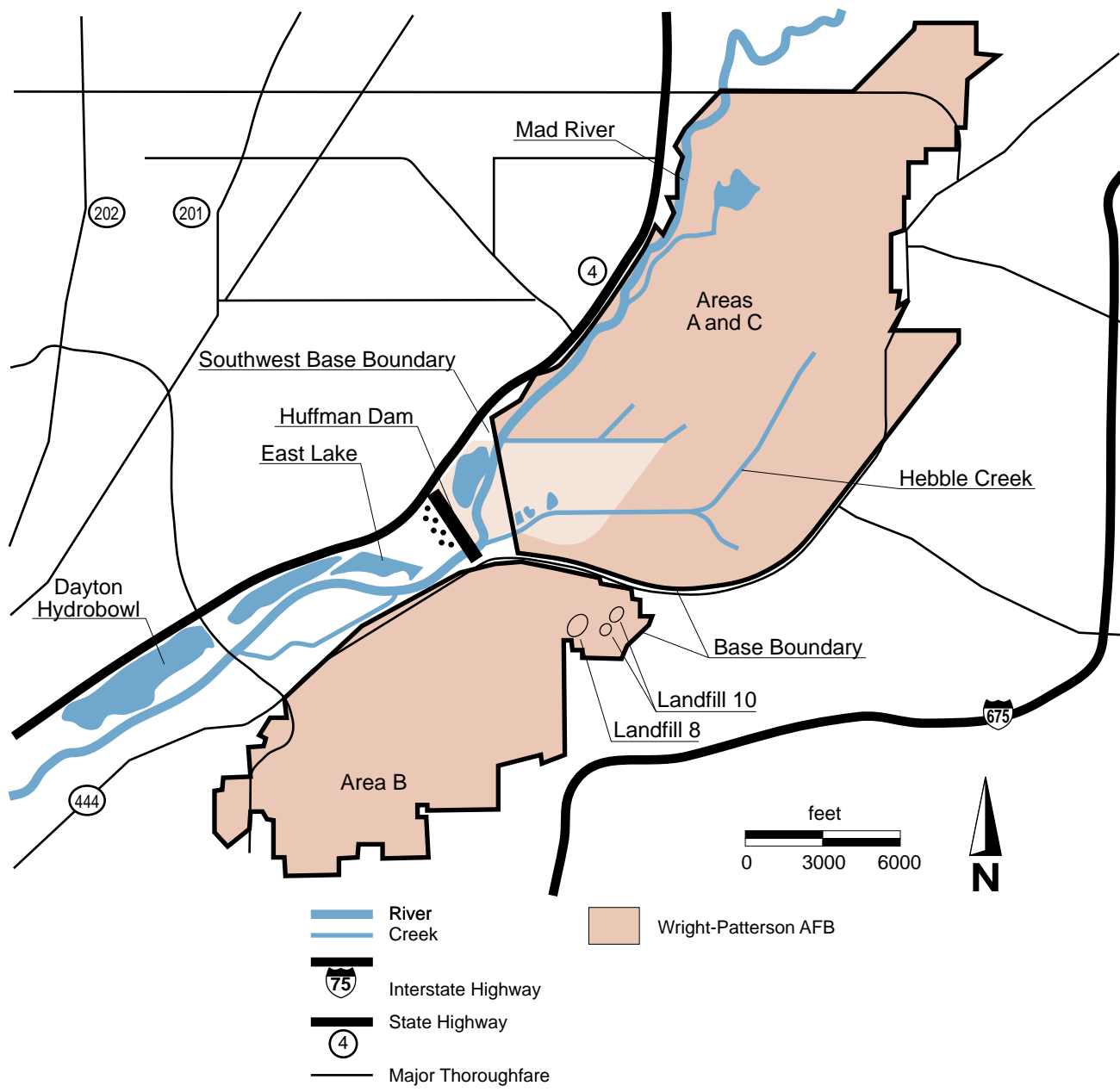
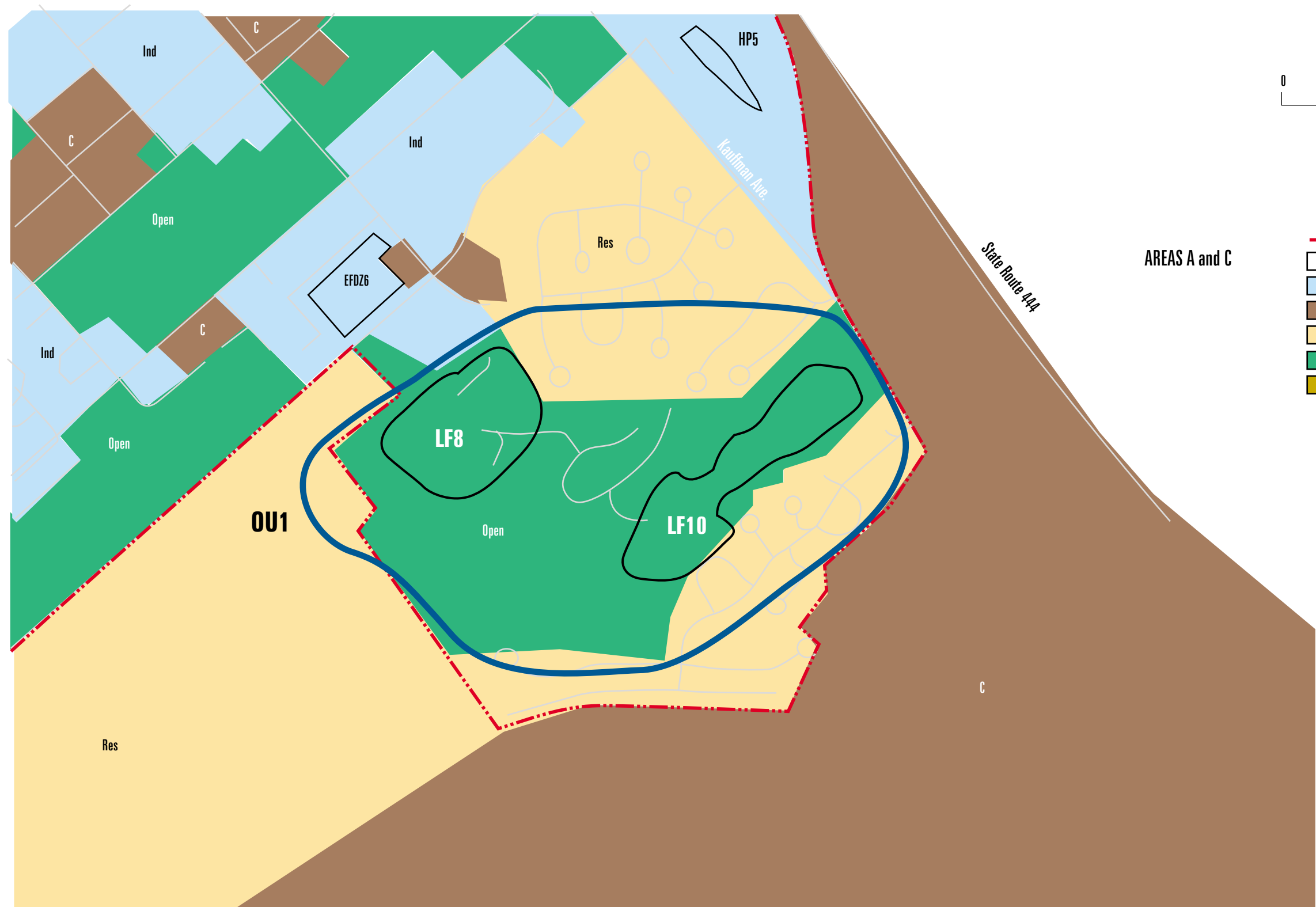
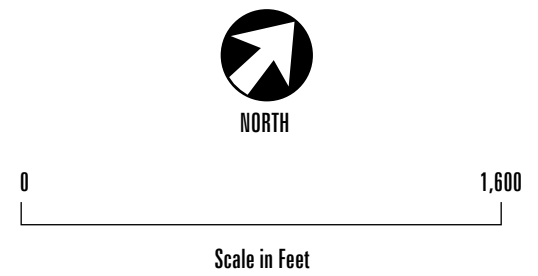


Figure 5-1. Location of Landfills 8 and 10 Within WPAFB.



AREAS A and C



- LEGEND**
- Surface Water
 - Property Line
 - Airfield
 - Ind Industrial (including aircraft maintenance)
 - C Commercial (including administrative and office)
 - Res Residential
 - Open Open (including recreation)
 - Ag Agricultural



Figure 5-2.
Existing Land Use – Area B

DRAWING NO.		S-777097.05-7/99-3w	
DRAWING BY	JIS, III	CHECKED BY	TC
	7/2/99		7/7/99
		APPROVED BY	

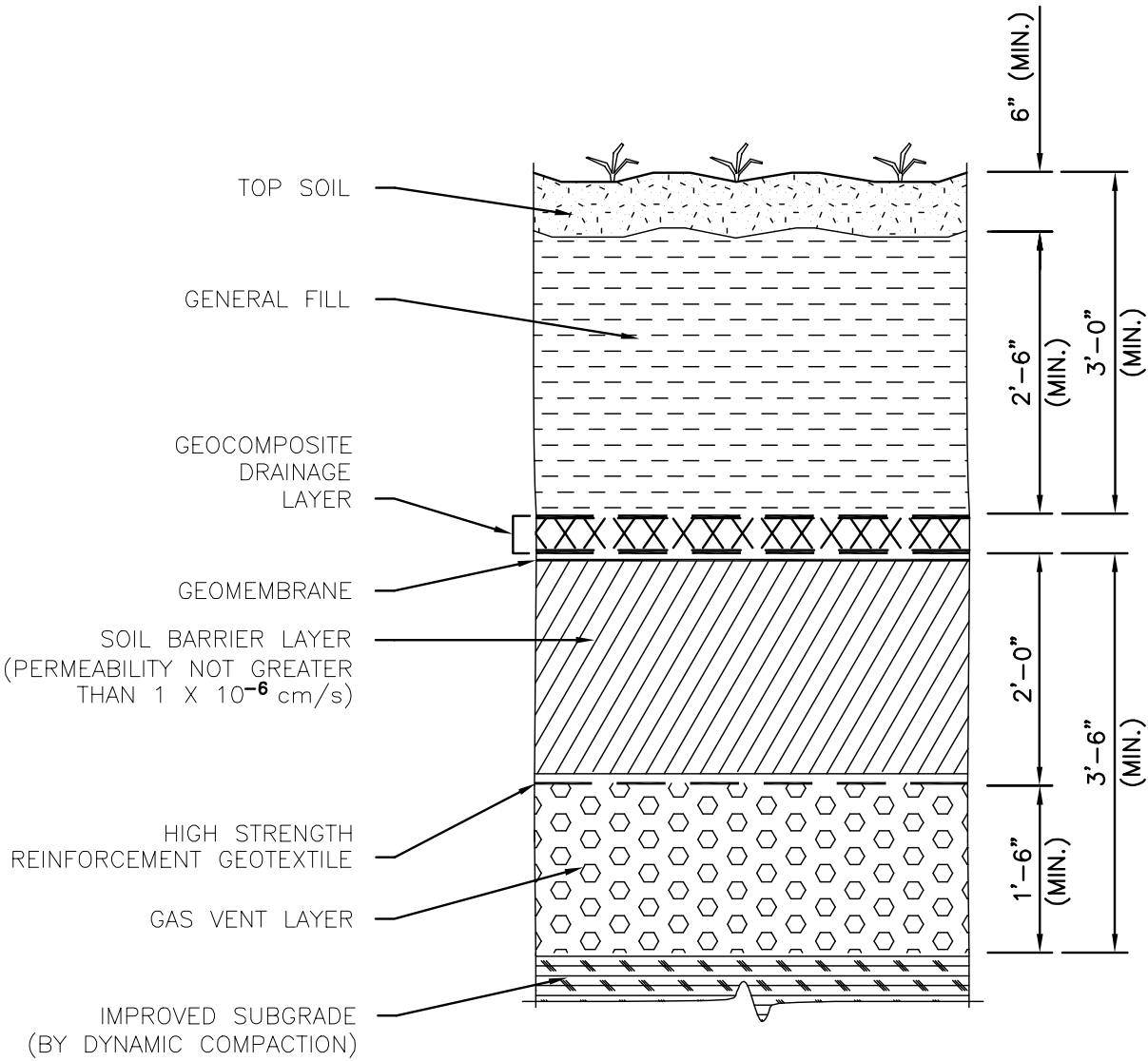
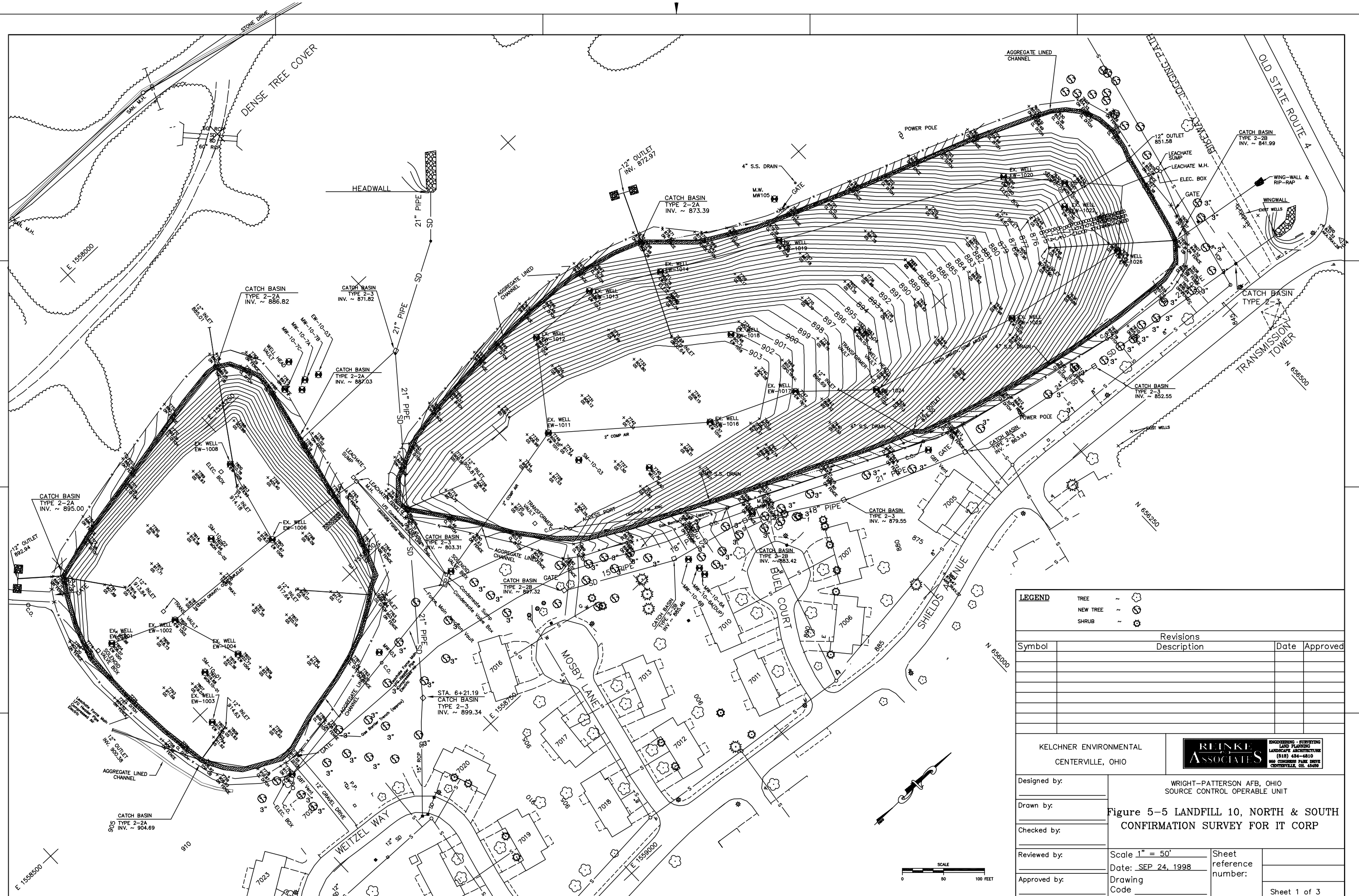


FIGURE 5-3
TYPICAL LANDFILL CAP COMPONENTS

NOT TO SCALE



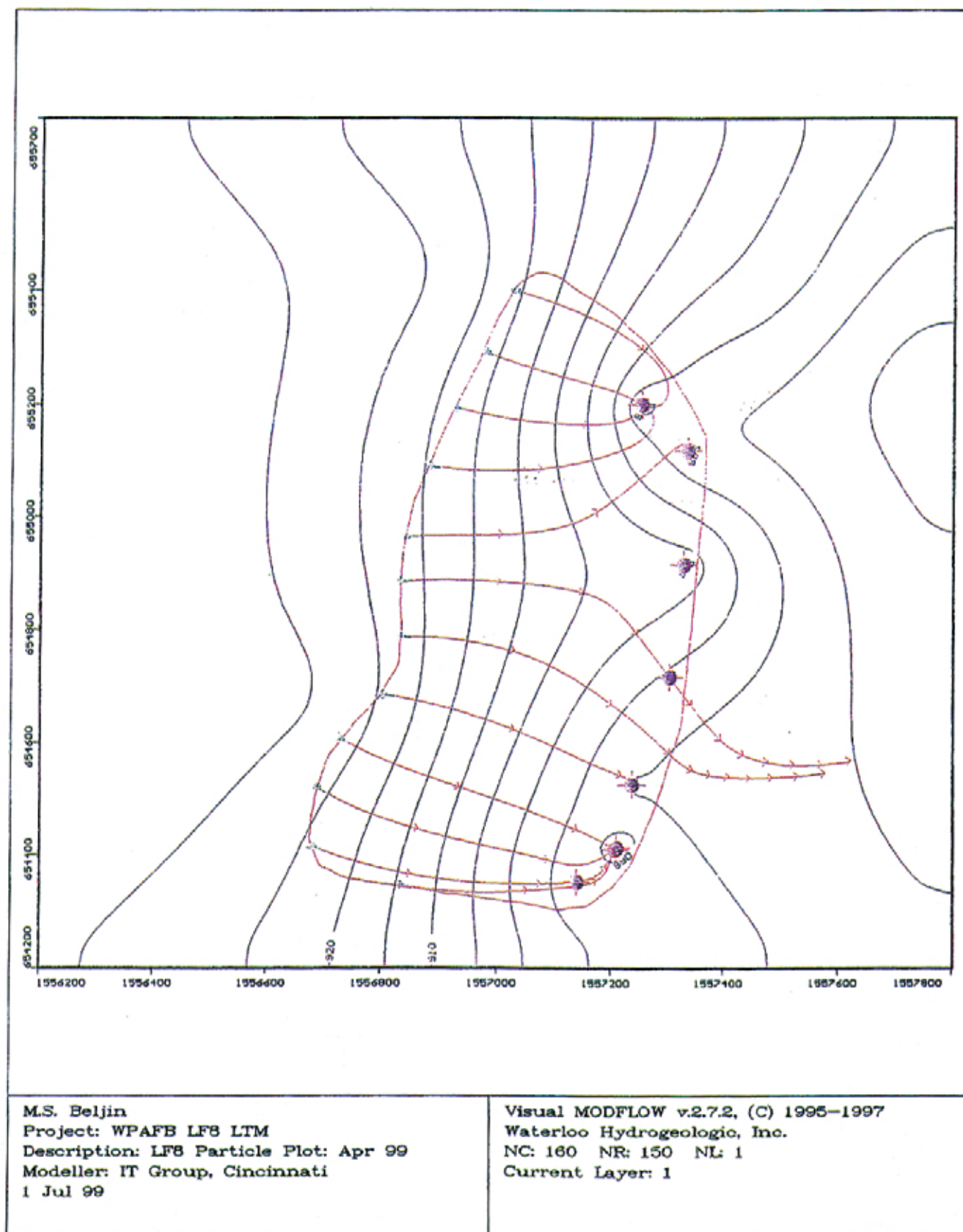


Figure 5-6
LF8 Particle Tracking: April 1999

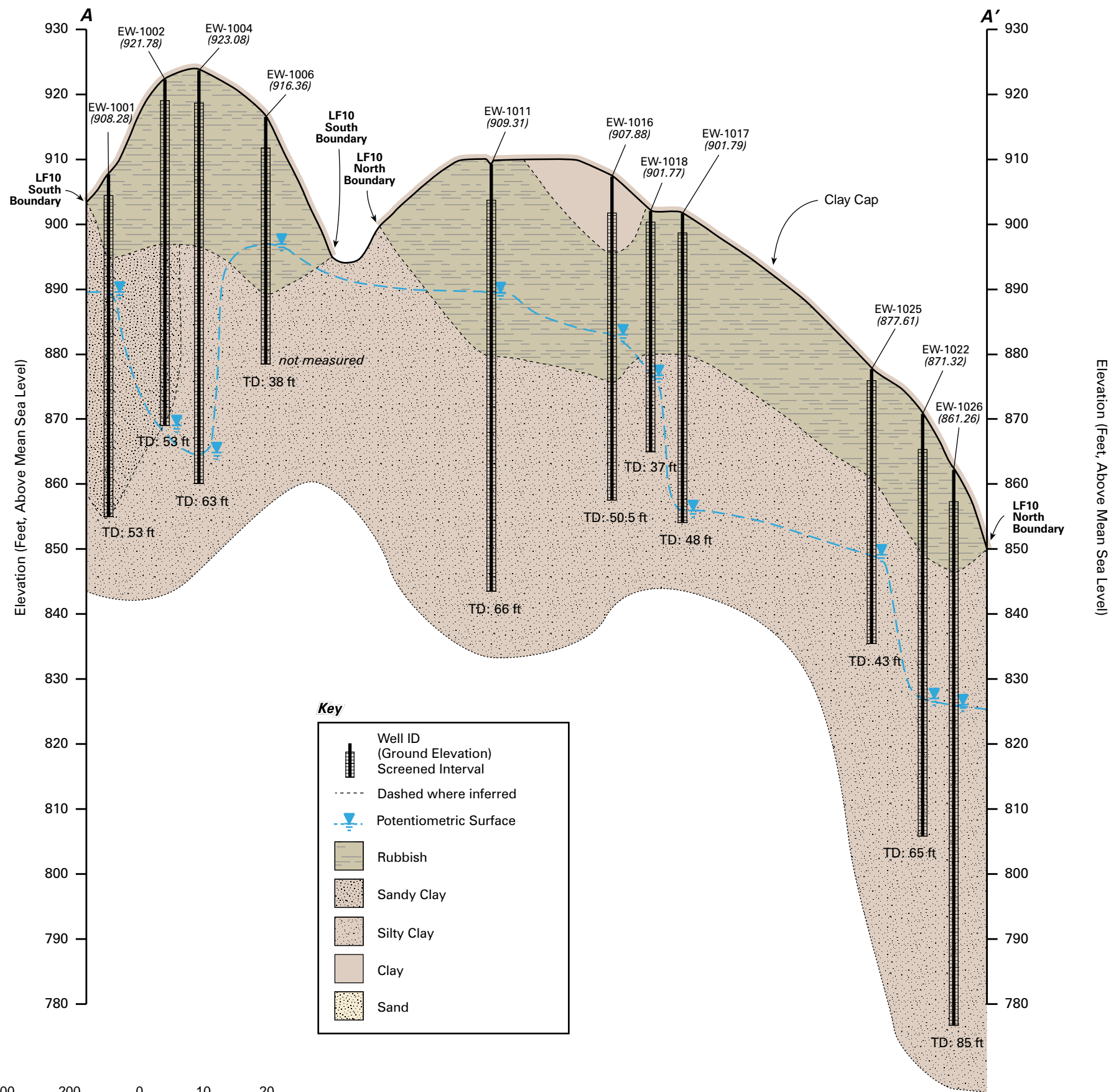


Figure 5-7.
Landfill 10 Geologic Cross-Section and
Potentiometric Surface: April 1999.



IT CORPORATION

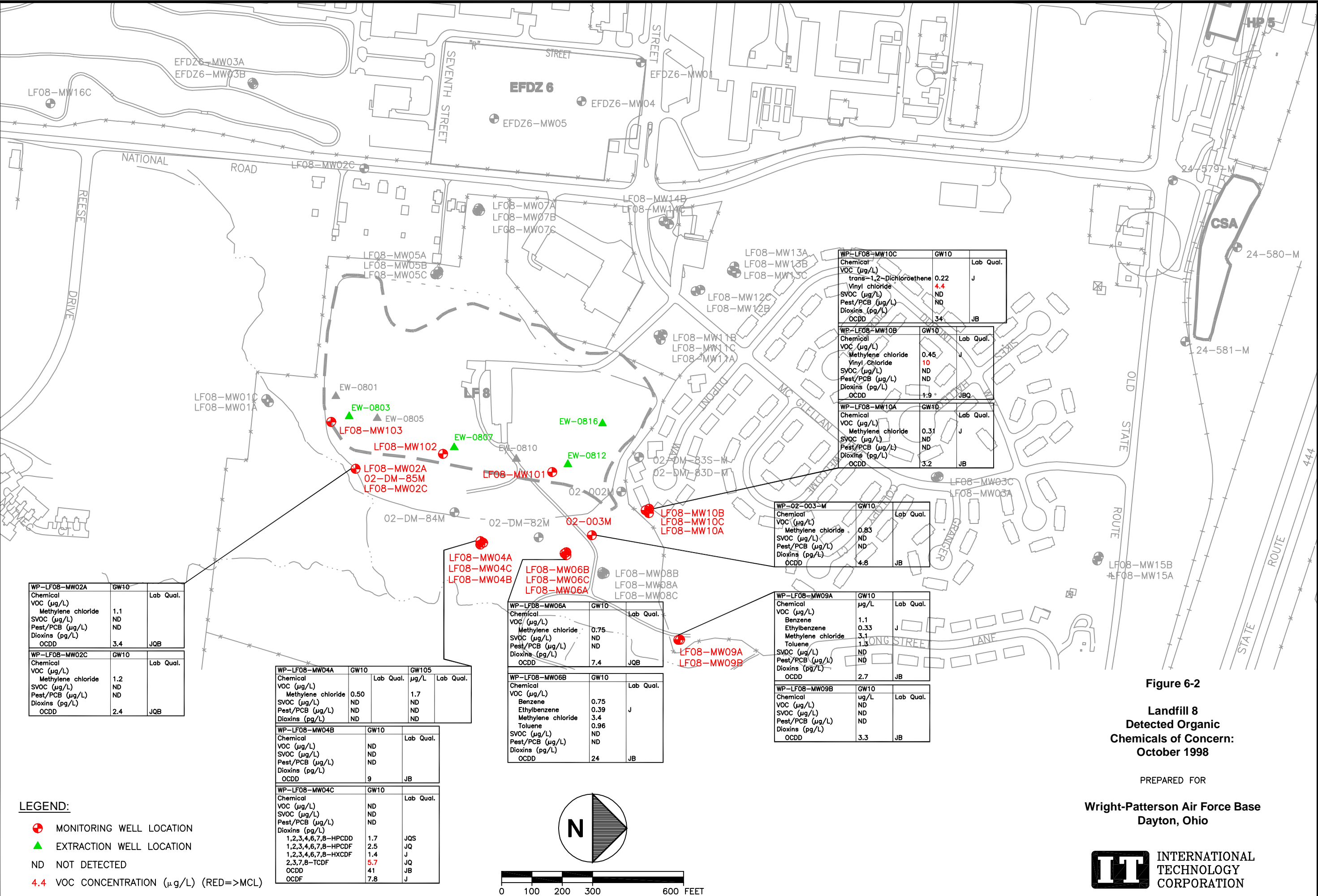


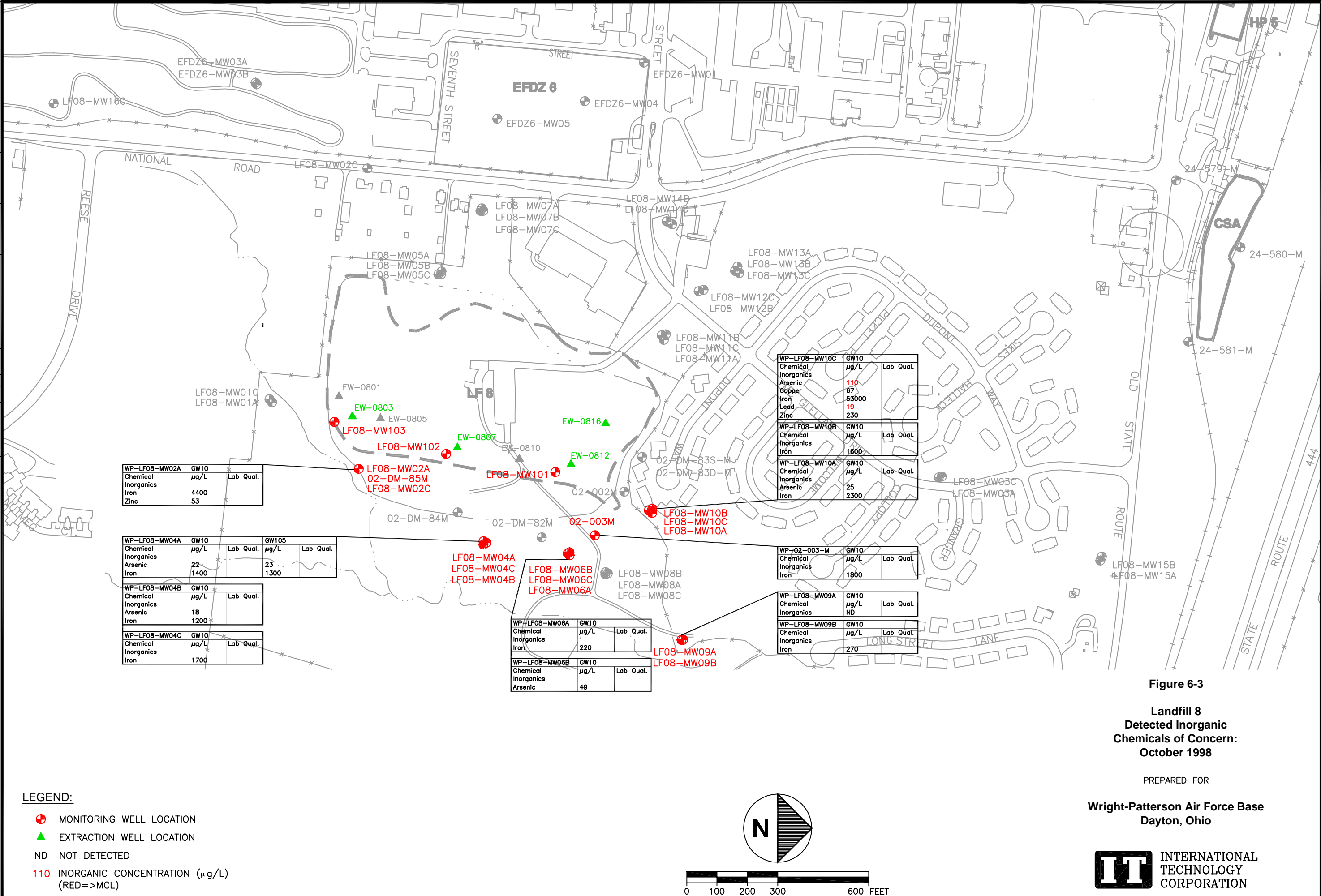
Figure 6-2

Landfill 8
Detected Organic
Chemicals of Concern:
October 1998

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Dayton, Ohio





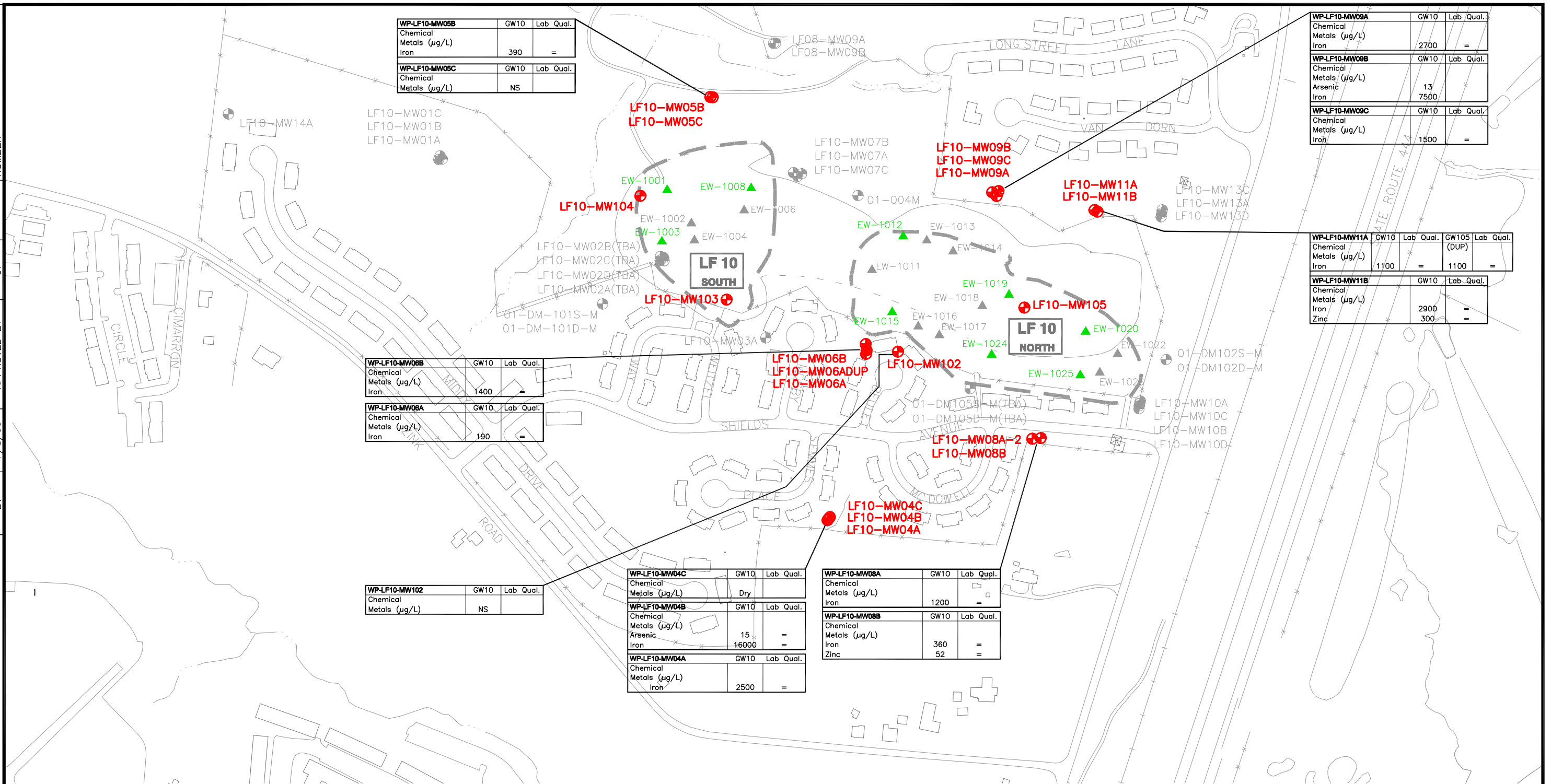




Figure 6-5
Landfill 10
Detected Inorganic
Chemicals of Concern:
October 1998

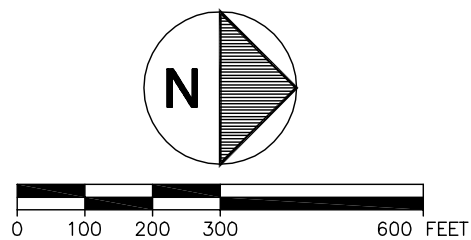
PREPARED FOR

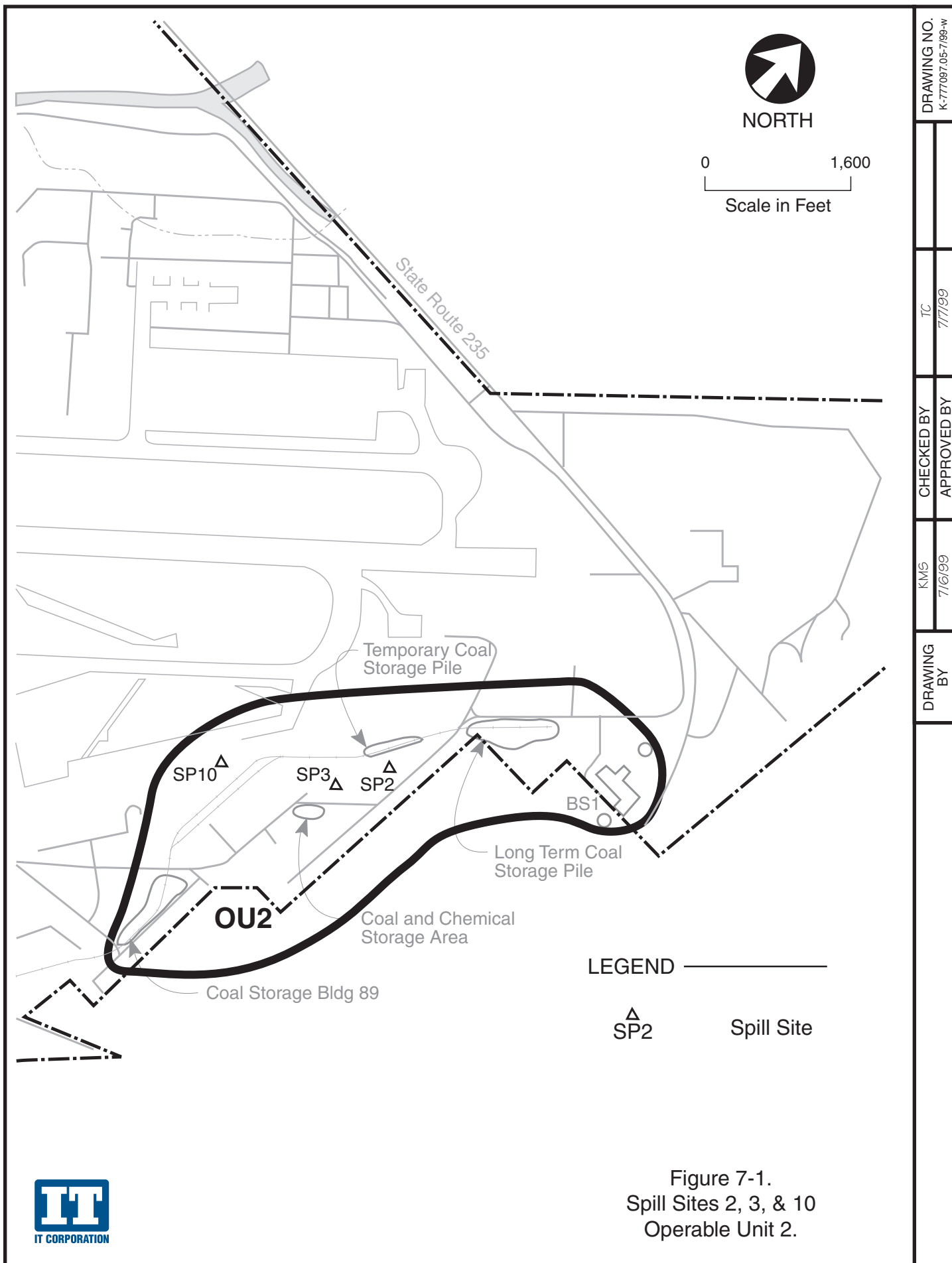
**Wright-Patterson Air Force Base
Dayton, Ohio**



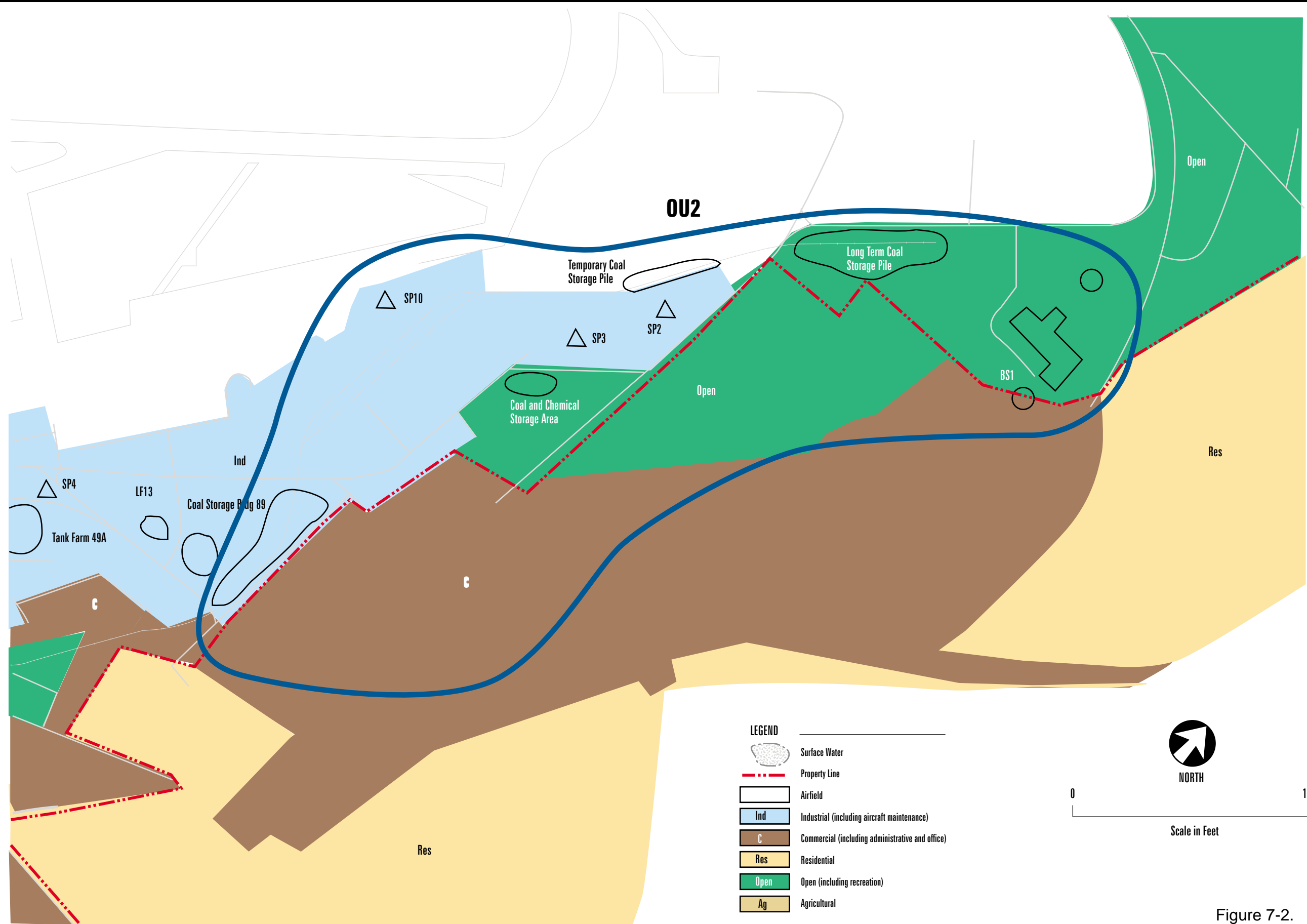
LEGEND:

-  MONITORING WELL LOCATION
 EXTRACTION WELL LOCATION
 ND NOT DETECTED
 NS NOT SAMPLED













DRAWING NO.	K-777097.05-7/99-W		
CHECKED BY	TC		
APPROVED BY	7/7/99		
DRAWING BY	KMS		
	7/6/99		



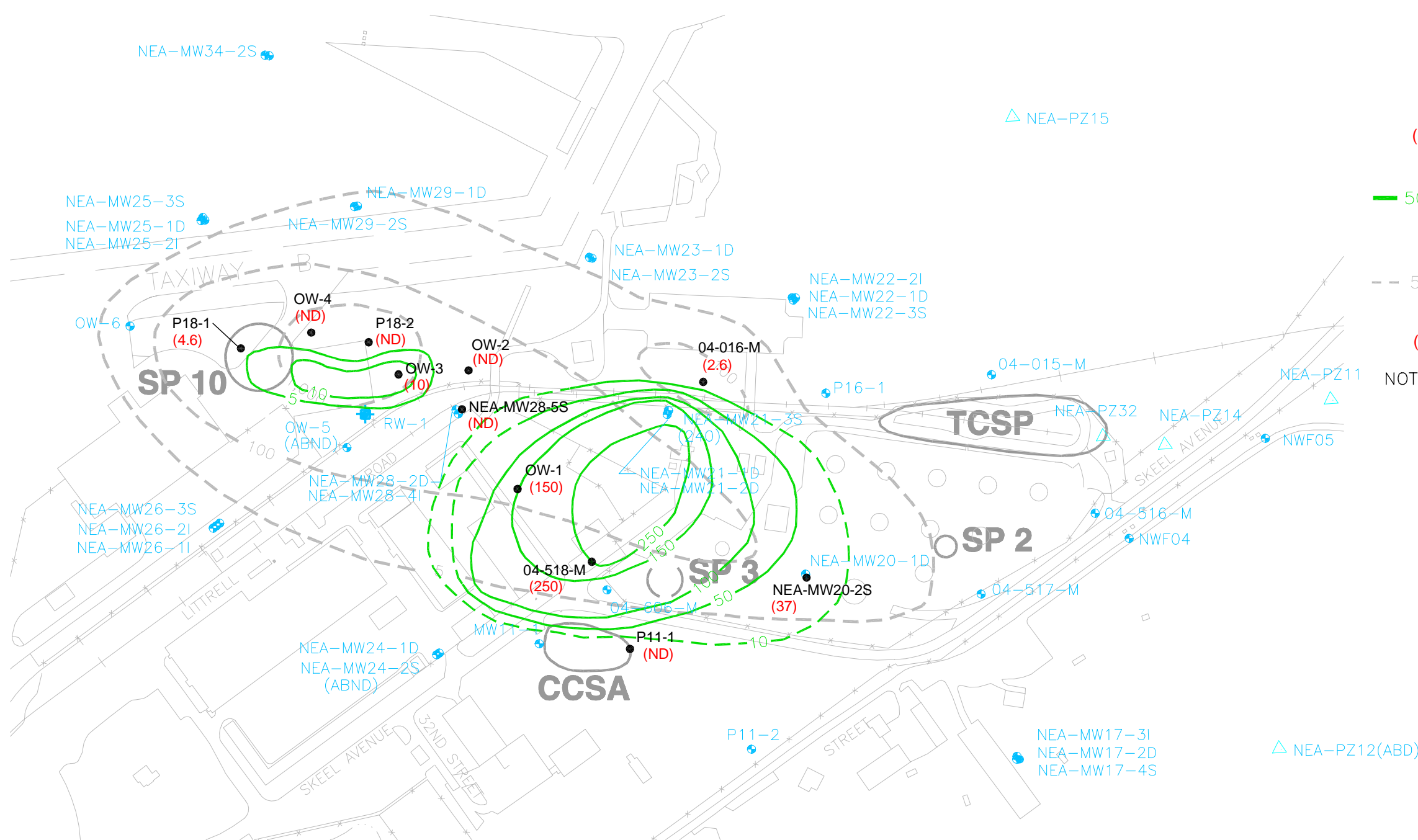
LEGEND

-  Surface Water
-  Property Line
-  Airfield
-  Ind Industrial (including aircraft maintenance)
-  C Commercial (including administrative and office)
-  Res Residential
-  Open Open (including recreation)
-  Ag Agricultural



0 1,600
Scale in Feet

Figure 7-2.
Existing Land Use – Operable Unit 2.



- LEGEND:**
- GROUNDWATER MONITORING WELLS
 - GROUNDWATER MONITORING WELLS SAMPLED DURING SUCCESSIVE MONITORING PROGRAM.
 - (52) ROUND 4 BENZENE GROUNDWATER CONCENTRATION, (µg/L.)
 - 50 — ROUND 4 BENZENE ISOPLETH, (µg/L.) (DASHED WHERE INFERRED)
 - - 5 - - 1991-1992 BENZENE ISOPLETH, (µg/L.)
 - (ND) NOT DETECTED
- NOTE: 1. ALL WELLS SHOWN IN BLACK ON FIGURE WILL BE SAMPLED DURING THE PERIODIC MONITORING PROGRAM.

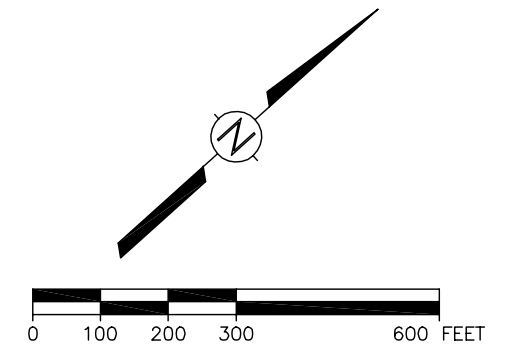
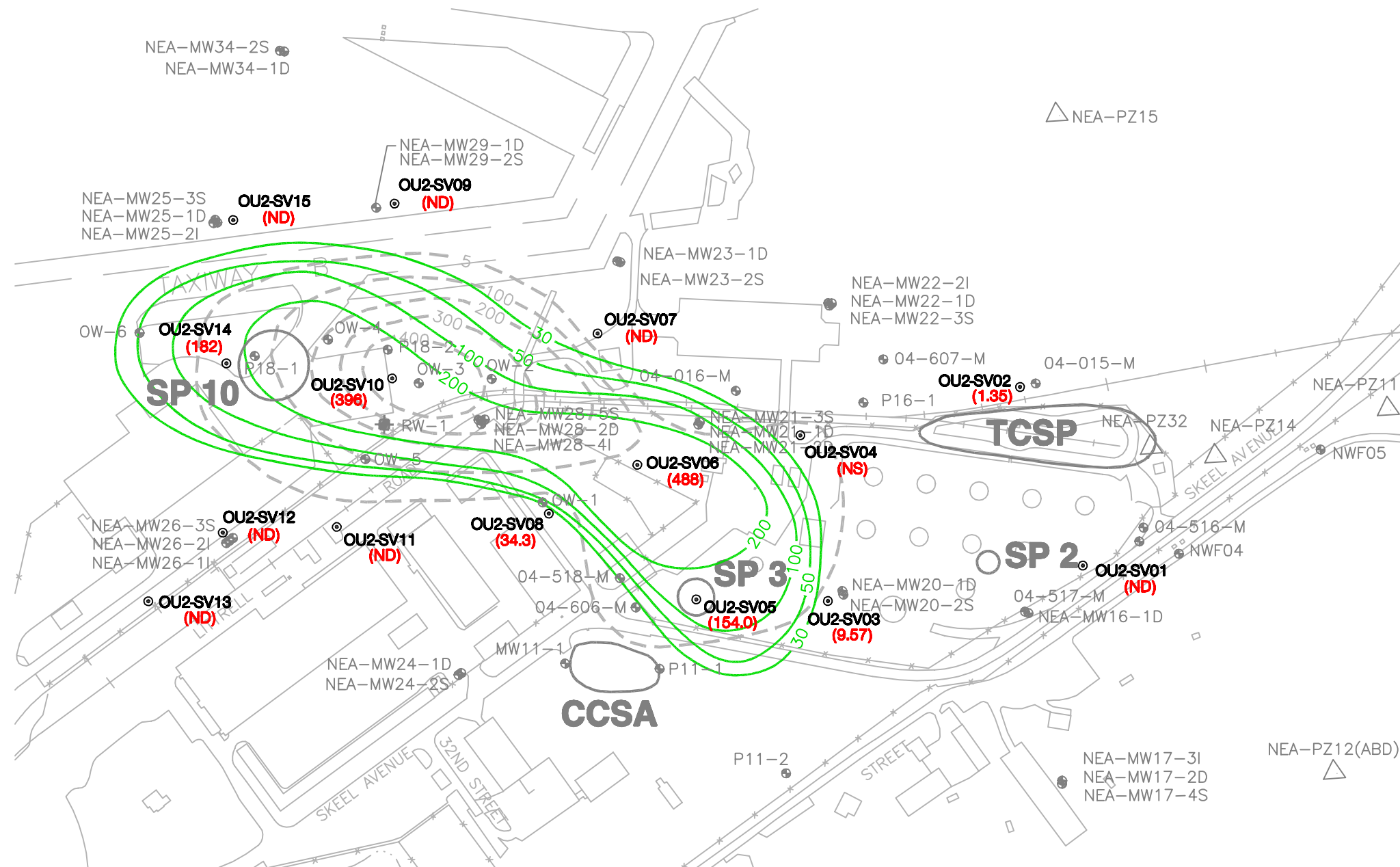


Figure 7-3
Round 4 Groundwater Monitoring
Results: Benzene
OU2 Area, April 1999

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Dayton, Ohio



- LEGEND:**
- SOIL VAPOR MONITORING POINTS
 - (12) ROUND 4 BTEX SOIL VAPOR CONCENTRATIONS, ($\mu\text{g/L}$).
 - 30 ROUND 4 BTEX SOIL VAPOR ISOPLETH, ($\mu\text{g/L}$). (DASHED WHERE INFERRED)
 - 200 BASELINE BTEX ISOPLETH, (MAY 1997) ($\mu\text{g/L}$).
 - (ND) NOT DETECTED
 - (NS) NOT SAMPLED

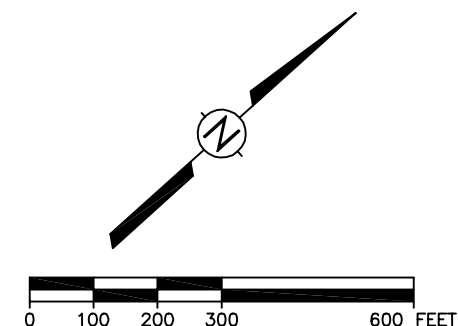


Figure 7-4
Round 4 Soil Gas Monitoring
Results: Benzene
OU2 Area, April 1999

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Base Dayton, Ohio